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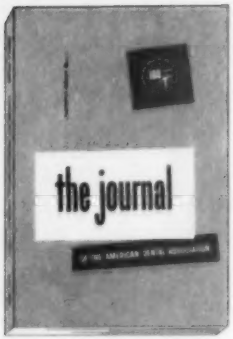

November 1959 • Vol. 59 • No. 5 • Lon W. Morrey, D.D.S., Editor

in this issue

Protective coronal coverage of pulpless tooth—Frank 895
Pulp reaction to caries—Boyle 900
Biology of the pulp—James-Schour-Spence 903
Pulp response to restorative materials—Zander 911
Pulp reaction to full crown preparations—Seltzer-Bender 915
Use of dehydrated pancreas—Jensen 923
Malocclusion and psychological factors—Secord-Backman 931
Denture outline form—Maison 938
Mathematics and full crown construction—Lewis-Owen 943
Silicone material for cavity impressions—Rubinstein 948
Irritational qualities of dental materials—Mitchell 954
Copper band rubber base impressions—Eastman 966
Radiation in dental offices—Crandell 971
Cases and comments 976
Editorials 977
International correspondence 981
News of dentistry 984
Reports of councils and bureaus 1003
Book reviews 1020
Current literature 1024
Deaths 1027
Directory 1030
Announcements 1034

in the next issue

Vice President Nixon's remarks at the Centennial Session
Fluoride dentifrices—Hill
Auditory analgesia in dental operations—Gardner-Licklider
Genetic effects of roentgen rays—Kaufmann

in future issues look for

Effective utilization of dental auxiliary personnel
Problems facing the dental graduate as he enters practice

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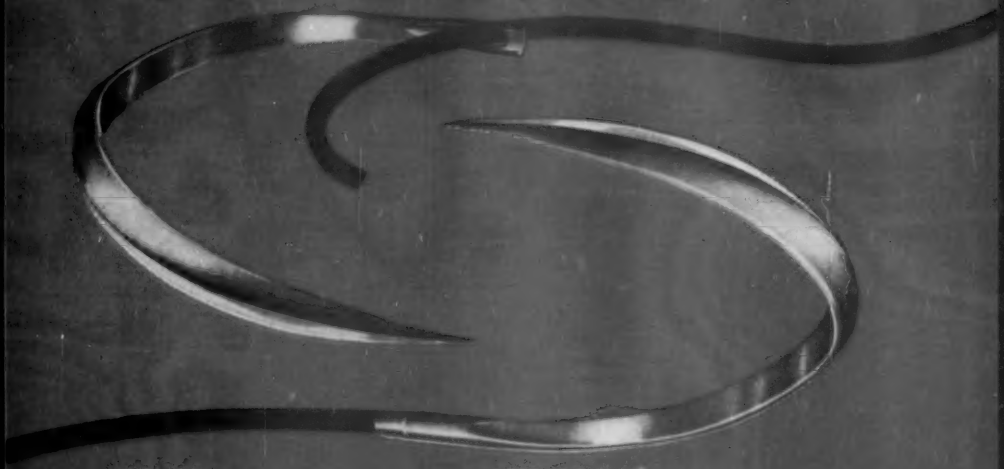

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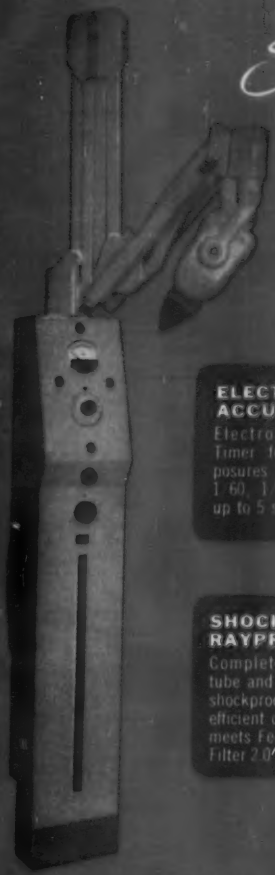

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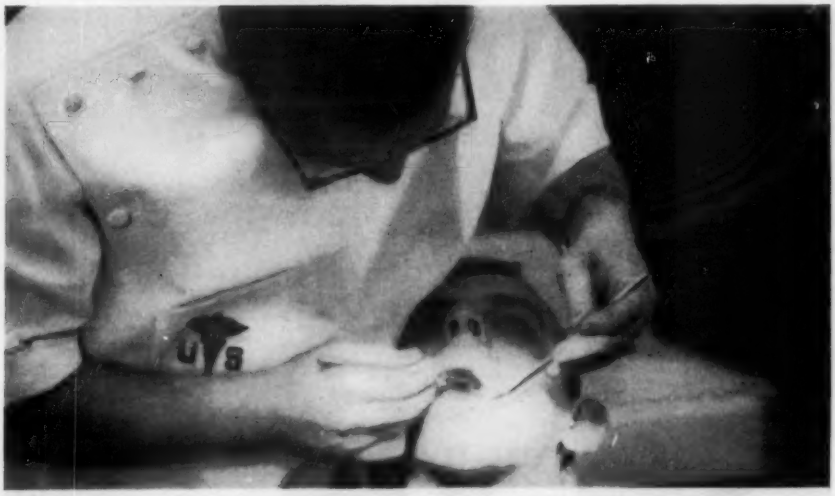

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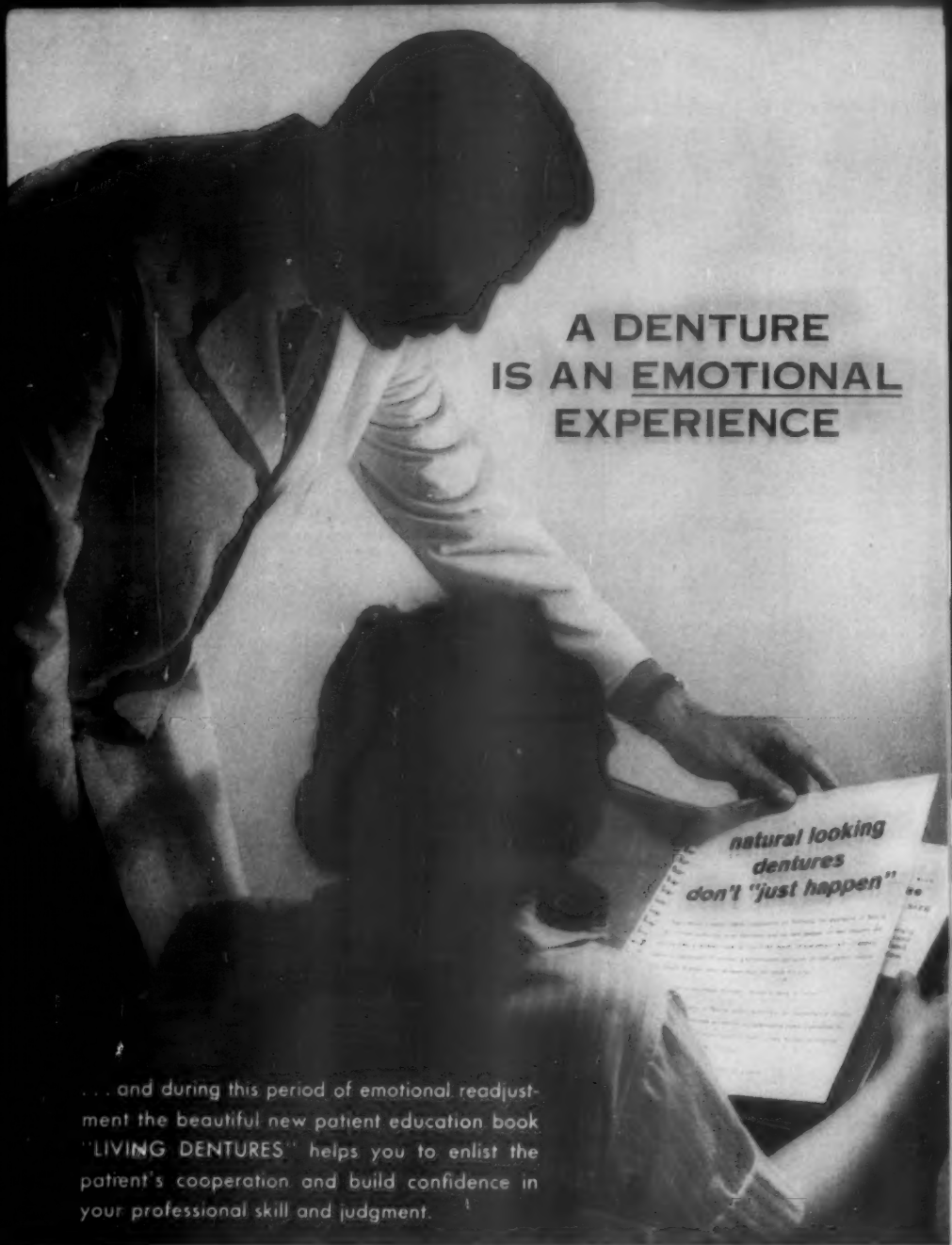

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Protective coronal coverage of the pulpless tooth

Alfred L. Frank, D.D.S., Inglewood, Calif.*

In the restoration of the pulpless tooth, the utmost care and preoperative planning must be utilized to assure that the remaining tooth structure be given maximum strength. The coronal restoration should be considered at the time of endodontic therapy. A major shortcoming has been failure to cap or tie together the buccal and lingual cusps.

In spite of the continuous trend toward more specialized areas in dentistry, the interdependence among various phases is found constantly. This is true in the field of endodontics, which cannot be dissociated from the restorative phase of dentistry.

How frustrating it is to see a tooth, in which a well planned and executed endodontic procedure had been carried out, end in the beaks of the exodontist's forceps because the last and final step in the procedure was not executed properly. All too often, however, this is the case.

The proper restoration of the pulpless tooth is no less important a step than the proper intial opening into the canal.

It has never been shown adequately that the pulpless tooth is a more brittle tooth; however, most dentists have had the unhappy experience of fragmentation during the extraction of such a tooth and have found that a glasslike brittleness may exist. In light of this experience, it is imperative that the utmost care and preoperative planning be utilized in the selection of the final restoration. Only by such consideration can the maximum strength and retentive features of what little usable tooth structure remains be realized.

In all instances where the marginal ridge is no longer intact, the buccal and lingual cusps should be capped or tied together to give the coronal portion of the tooth a chain of continuous strength (Fig. 1, 2). The MOD onlay probably is

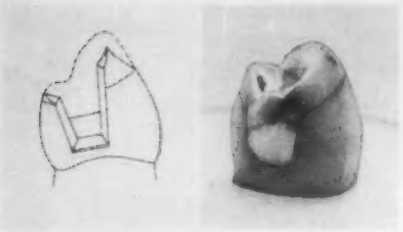


Fig. 1 • MOD onlay, mandibular first bicuspid. Left: Schematic drawing. Right: Casting in place

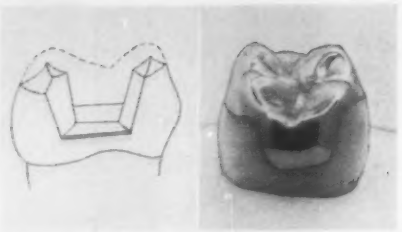


Fig. 2 • MOD onlay, mandibular first molar. Left: Schematic drawing. Right: Casting in place

the most widely utilized technic employing this ring of continuous strength. Failure to cap these cusps has been the major shortcoming in restoring to function the tooth in which a root canal filling has been placed. The minimum preparation for the posterior tooth with any appreciable amount of dentin destruction should be the onlay preparation. The condition of the proximal walls should determine the number of surfaces to be included.

THE DOWEL PREPARATION

Whenever feasible and for additional strength and retention, the dowel is available.

In the dowel preparation, every effort should be made to obtain as much retention as possible by making the dowel as long as practicable or by increasing the width of the walls to enlarge the area of lateral contact. There is a direct correlation between the lateral area of the dowel and the retention that it affords.

Caution In Dowel Preparation • The basic precautionary measures in dowel preparation are as follows:

1. Overpreparation leaving a thin shell of dentin surrounding the dowel should be avoided.
2. The direction of the dowel should be planned to avoid lateral perforation.
3. Dislodgment or loosening of the root canal filling material must be avoided, especially when silver points have been used.

Any preparation in which the dowel is utilized should have a collar of gold encircling the greater circumference of the tooth.

Full Coverage • The badly broken down tooth should have full coverage whenever necessary. Many times, however, the preparation for a full crown would sacrifice additional sources of retention such as parallel walls, and would leave in its stead a frail unsupported spur of tooth. (Fig. 3, 4). It is obvious in such a situation that little advantage would be derived from a full crown preparation. Utilization of the remaining cusp adds retentive features otherwise lost. With the dowel and collar preparation, additional strength and power of retention are imparted to the tooth. This preparation is indicated after a fracture of the buccal or lingual cusp on teeth that were not initially protected properly.

It is interesting to note at this time that the efforts of another branch of dentistry are needed to assist in preserving the tooth which has been fractured below the gingiva or the alveolar crest. Often by performing a gingivectomy and an osteoplasty when necessary for preparation access, it is possible to retain an otherwise doomed tooth.

Restoring the Anterior Tooth • In restoring the badly broken down anterior

Fig. 3 • Three-quarter crown with dowel restoring lingual cusp. Left: Schematic drawing. Center left: Preparation. Center right: Casting. Right: Casting in place

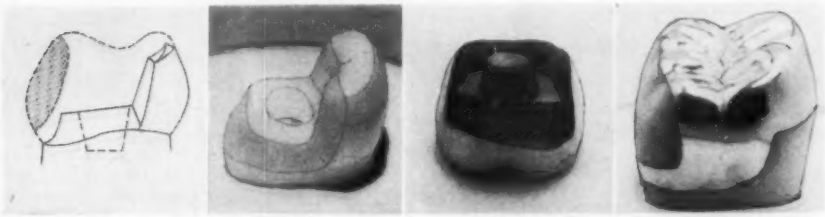


Fig. 4 • Three-quarter crown with dowel, restoring buccal cusp. Left: Schematic drawing. Center left: Preparation. Center right: Casting. Right: Casting with plastic facing in place

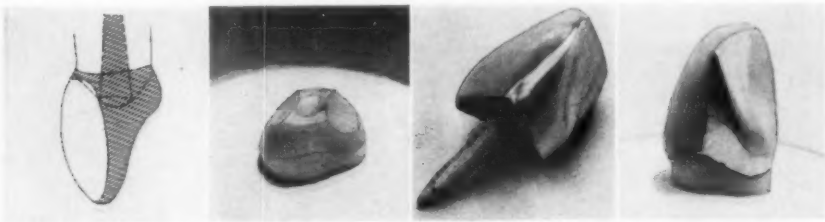


Fig. 5 • Richmond crown. Left: Schematic drawing. Center left: Preparation. Center right: Casting with acrylic facing. Right: Casting in place

tooth, the old stand-by has been, and not without justification, the Richmond crown or one of its many variations (Fig. 5). However, if the slightest possibility exists that this tooth will be called on at a later date to serve as a bridge abutment, or for any reason will have to be remade, the Richmond crown should be avoided. It is difficult enough to remove an insufficiently doweled Richmond crown, let alone one which is properly constructed. The risk of fracturing the remaining tooth or root is always present. Therefore, in such instances, it is preferable to use the full coping with the collar and dowel (Fig. 6).

If the full coping with collar and dowel is cemented to place independently of the subsequent crown, the tooth is restored to serve as a base for future restorations of any type. This eliminates the risk if the crown will have to be remade. It is a decided advantage in full mouth rehabilitation.

Where there is ample tooth structure to make a full coping unnecessary and at the same time not enough to allow for length of preparation, the dowel and extension should be used (Fig. 7). This, too, permits the tooth to be a strong restorable member as does the full coping.

Dowel For Existing Crown • Occasionally an endodontic procedure must salvage an extensive previously completed fixed prosthesis such as an abutment for a multi-unit bridge. Rather than reconstruct the entire bridge, a dowel preparation with as much dovetail as possible in the original casting should be considered (Fig. 8). By means of the dovetail, additional strength and retention of the dowel is distributed to the crown itself. By locking the dowel to the crown, a single unitized doweled restoration is obtained.

Double-Abutting • Too often a tooth is condemned rather than employed as an abutment for an internal retention partial denture. By judicious double-abut-

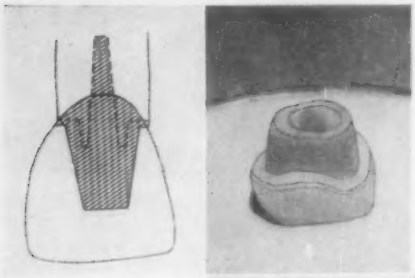


Fig. 6 • Full coping with dowel. Above left: Schematic drawing. Above right: Preparation. Below left: Casting of coping. Below center: Coping in place. Below right: Subsequently cemented jacket. Note all important collar of gold encircling stump

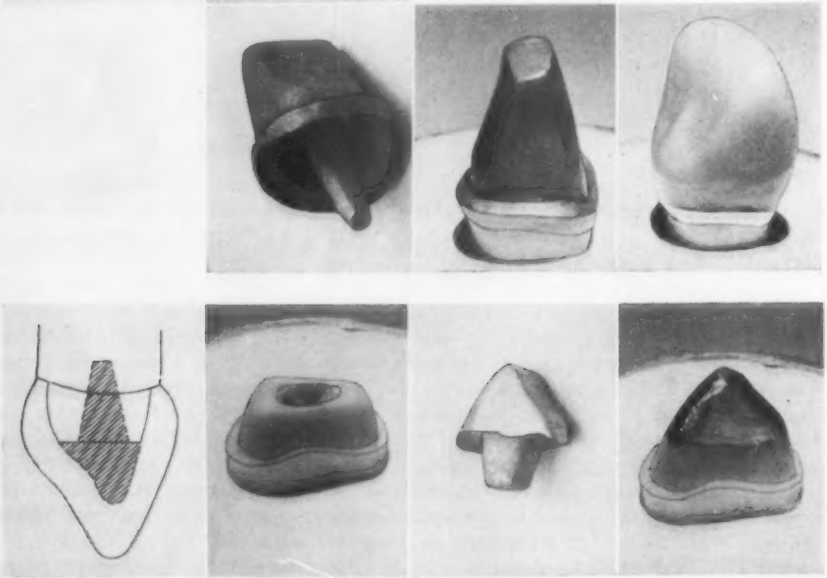


Fig. 7 • Dowel and extension for increasing length of preparation. Left: Schematic drawing. Center left: Preparation. Center right: Casting. Right: Casting in place

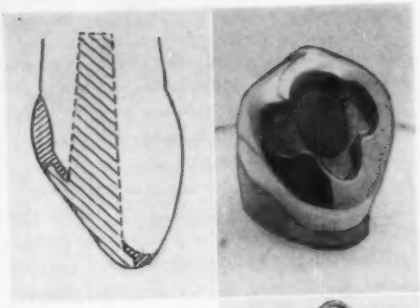
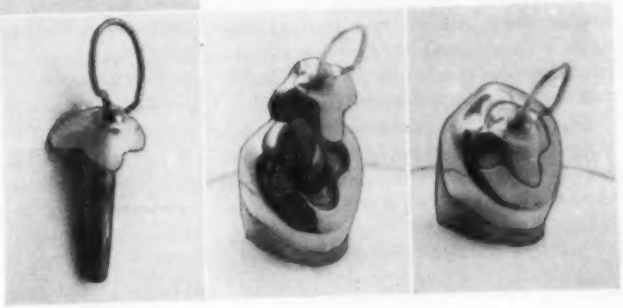


Fig. 8 • Dowel support for previously cemented crown. Above left: Schematic drawing. Above right: Preparation in crown. Note dovetail. Below left: Dowel casting. Below center: Casting and preparation. Below right: Casting in place



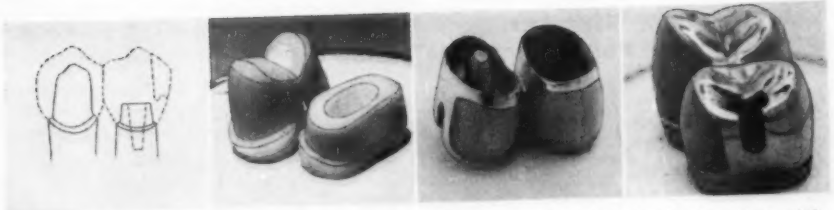


Fig. 9 • Double abutment for internal retention partial denture. Left: Schematic drawing. Center left: Preparation. Center right: Casting. Right: Casting in place

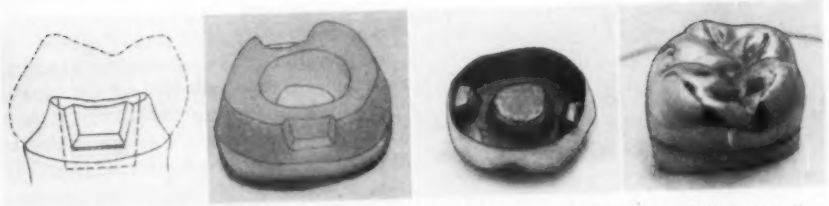


Fig. 10 • Full crown with dowel and retentive steps. Left: Schematic drawing. Center left: Preparation. Center right: Casting. Right: Casting in place

ting, the strength of the adjacent tooth is imparted to its weaker neighbor (Fig. 9). The advantage of the multiple abutting should be considered if any doubt exists as to the dependability of the restored broken-down pulpless tooth.

Multiple Choice of Preparations • No single technic can be the answer in every case. All possible means of strength and retention should be considered at the time of preparation. Often a finish line crown is used along with the dowel and if sufficient bulk of tooth structure is present, proximal box forms are prepared to increase the retentive features (Fig. 10).

There are many variations of preparations available. It is important to remember that the root canal filling alone is not the final effort in the preservation of that tooth.

SUMMARY

Consideration must be given various operative and periodontal technics to protect the pulpless tooth or to restore the fractured tooth which previously had not been restored properly.

Failure to consider the coronal restoration of the pulpless tooth at the time of the endodontic therapy is a disservice to the patient and the operator. The patient must be advised of the necessity of this coronal protection during the original diagnosis.

Every available technic should be considered to restore the tooth properly with the permanence that should be its due.

3110 West Imperial Highway

*Clinical instructor, department of endodontics, University of Southern California School of Dentistry, Los Angeles.

Pulp reaction to caries

Paul E. Boyle, D.M.D., Cleveland*

A review of the carious process shows that the presence of microorganisms, proteolysis and acid softening of the calcified dental tissues distinguishes dental caries from other processes, erosion or attrition, which affect tooth structure. The toxicity of the bacterial products of caries has not been tested, nor has the hypothesis that the bacteria associated with caries exert an antibiotic effect on the pyogenic microorganisms associated with inflammation and abscess formation of the pulp.

The dental pulp is the tooth's formative, nutritive and sensory organ, and in these respects corresponds in function to the marrow of bone. It is a richly vascular connective tissue with highly specialized peripheral cells, the odontoblasts, which are believed to originate from the mesectodermal, embryonic tissue. The protoplasmic processes of the odontoblasts, at least in recently erupted teeth, extend to the inner zone of the enamel. Physiologically, therefore, this is the extent of the pulpal tissue, and the pulpal reaction

to caries must include changes in the odontoblastic processes in addition to the laying down of secondary dentin and other changes in the pulpal tissue proper. These changes also may occur as the result of aging and such attendant processes as erosion, attrition or abrasion.

DEVELOPMENT OF CARIES

Caries is a process which starts on exposed tooth surfaces, enamel, cementum or dentin, and progresses at a variable rate, with resultant cavity formation and eventual pulp exposure. It must be distinguished from erosion and attrition or abrasion.

Microorganisms are essential to the development of caries.[1] Aciduric and acidogenic forms are believed by a majority of investigators to be responsible for the initiation and progress of the carious process. A surface microbial plaque composed of filamentous forms overlies an area in which a cavity may eventually develop.

A glucose rinse may cause a drop in pH below 5—the critical point for enamel decalcification — in caries - susceptible mouths.[2] Lactobacilli may be isolated from such plaques with a high degree of uniformity for some weeks or months before a cavity appears.[3]

The first clinical sign of caries is a white area which may increase in size, become "chalky," soft to a probe, and eventually disintegrate with cavitation. Yellow pigmentation may occur. In slowly progressing or "arrested" caries, the affected area may become black. The white chalky areas of carious enamel contain three to four times as much organic matter as adjacent sound enamel.[4]

Early carious lesions of the enamel show increased permeability to staining procedures. When examined under polarized light, enamel shows a characteristic zoning which has been described by Darling.[5] Most, if not all, of these changes have been duplicated in artificial caries and in enamel decalcification by dilute lactic acid solutions.

Darling[5] also has described an expanding early carious lesion under a relatively hard and resistant surface layer of enamel. The concept of microscopic points of entry and subsequent development of lesions below the surface which eventually rupture to the surface is similar to the formation of microabscesses of the epidermis or, on a larger scale, to the development of furuncles or carbuncles. Frisbie and associates[6] have demonstrated microorganisms penetrating deeply through clinically intact enamel to the outer surface of the dentin. These organisms are spheroidal. Little is known of their biological characteristics.

Enamel lamellae are believed to be the portals of entry and major pathways of progress through the enamel to the dentin. They are relatively soft and are high in organic matter compared to other parts of enamel. The possibility of proteolytic microorganisms first atttacking the organic framework of enamel with concomitant or subsequent decalcification or chelation of the inorganic component has been suggested by a number of investigators but must be regarded as yet unconfirmed.

Once the process of caries has reached the dentin, either by penetrating the enamel or, more rarely, the cementum, or, in instances where the dentin has been exposed, directly, progress is facilitated by the tubular character of dentin and also by the less-well-calcified, interglobular regions. Microorganisms are found within the dentinal tubules. Proteolysis plays a well-recognized role in the dissolution of the dentin.

Softening of the dentin is believed by MacGregor and associates[7] to precede the invasion of organisms in the majority, at least, of carious cavities. This is held to indicate that the softening process is the result of the diffusion of acid acting at a distance from the organisms responsible for the acid production. It is considered

evidence against the theory of proteolysis, since bacterial enzymes are extremely localized in their activity.

These authors[7] report the absence of organisms and of signs of inflammation within the pulp in teeth with very deep cavities where, after the removal of soft caries by excavators, only a thin barrier of secondary dentin remained. They suggest that pulpitis due to the entry of organisms into the pulp must occur at a very late stage in the carious attack at the time when a deep cavity already exists.

The possibility that the microorganisms responsible for the carious softening and destruction of dentin are essentially nonirritating to living cells must be considered. It is conceivable even that the bacteria of caries are antagonistic to the true pathogens, those organisms which are capable of producing irritation, hyperemia, inflammation, abscess formation and, eventually, necrosis of the dental pulp.

Further studies of deep cavities where a thin barrier of hard dentin still overlies the pulp should be made. The removal of softened dentin with sterile excavators, using the technic of MacGregor and associates, might be followed by testing the biologic properties of the isolated organisms, as well as their morphological and cultural properties. The lactobacilli are essentially harmless to living cells, and numerous attempts have been made to use them as antagonists to pathogenic microorganisms.[8]

The view that the process of caries causes, by itself, a minimal disturbance to the underlying cells of the pulp, is strengthened by the clinical observation that deep caries can be removed, leaving hard but discolored dentin, and that no signs or symptoms of pulp disease may ensue. Indeed, the success of operative dentistry indicates that caries, up until the stage where the pulp tissue is actually exposed to mouth organisms, is a disease which can be successfully treated by mechanical removal and replacement of tooth structure by metallic or other restorative materials, with little attention to sterile procedures.

CONCLUSIONS AND SUMMARY

The presence of microorganisms, proteolysis and acid softening of the calcified dental tissues distinguishes dental caries from other processes, erosion or attrition, which affect tooth structure.

There is no evidence that pulpal reaction is stimulated by the process of caries in any different manner than by other equivalent, nonbacterial methods of tooth destruction.

The toxicity, if any, of the bacterial products of caries so far has not been tested.

The work of MacGregor and associates[7] indicates that bacteria do not invade the dentin in advance of the softening process of caries.

The hypothesis that the bacteria associated with caries exert an antibiotic effect on the pyogenic microorganisms associated with inflammation and abscess formation of the pulp has not, to my knowledge, been tested.

Pulpal reaction to caries varies with the rapidity of the carious process. In some instances, especially in children, the process extends rapidly (acute caries). Little sclerosis of primary dentin and little or no formation of secondary dentin may occur. The underlying pulpal tissue may show no evidence of response to what appears to be an essentially mild process of caries until secondary, pyogenic, bacteria gain access to the pulpal tissue, causing inflammation, abscess formation and necrosis.

In slowly progressing, chronic caries, extensive sclerosis of the primary dentin with the formation of large amounts of secondary dentin may occur. This pulpal response essentially is indistinguishable from the pulpal reaction to abrasion, attrition or erosion.

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Biology of the pulp and its defense

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To evaluate the response of dental pulp to inflammation (I) and secondary dentin formation (D), an ID index was proposed and utilized in experimental studies involving 166 human noncarious teeth. Cavity preparation and filling materials were used as the exciting factors. Subjects studied included range of pulpal response, sequence of events in pulpal response, pulpal response to the cutting of dentin, influence of cavity depth on pulpal response, and influence of age of the patient on pulpal response. The biology of the pulp is discussed in terms of its histophysiology and its experimental response.

Until recently, our knowledge of the biology of the pulp was based primarily on clinical observations and on histological studies of teeth that were extracted for various clinical reasons. With the recent advances in dental research, our observations have been significantly enriched by experimental studies which were designed to clarify specific questions and which provided a better understanding of the biologic potentials of the pulp. This article, therefore, will consider the biology of the pulp in terms of its histophysiology and of its experimental response.

The pulp is a connective tissue which is derived from the mesenchyme, the dental papilla. Its structural elements and physiology are, for the most part, very similar to loose connective tissue. However, the pulp is characterized by its specialized peripheral odontoblasts which maintain their long cytoplasmic processes within the tubules of the dentin that they help to form. As do most connective tissues, the pulp contains cells, fibers and ground substance. The pulpal ground substance is also different but its exact nature awaits further investigation.

The central portion of the pulp (Fig.

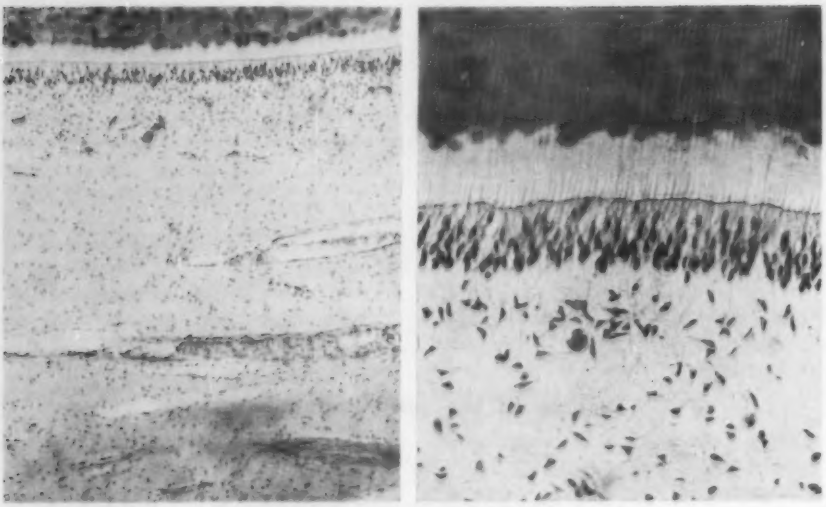

Fig. 1 • Left: Pulp of young human tooth, showing distribution of cells, fibers, nerves and blood vessels of central region as compared with peripheral portion. Right: Peripheral region of pulp in young human tooth, showing greater number of cells in "cell rich zone" as compared with "cell poor zone" or layer of Weil. Note arrangement of odontoblasts and pulpodentinal membrane separating them from predentin

1, left) contains many young fibroblasts. Its rich blood supply is characterized by numerous thin-walled but relatively wide capillaries. Bundles of myelinated nerve fibers accompany the blood vessels. The myelin sheath of the pulpal nerves appears to be relatively thinner than in those found in loose connective tissue elsewhere. Lying in close proximity to the blood vessels are many undifferentiated mesenchymal cells and a lesser number of histiocytes which are capable of storing vital dyes. Occasional lymphocytes have been observed, but mast cells which are commonly found in loose connective tissues in other regions are rarely seen in the pulp. The fibers are of the collagenous and reticular type and are relatively few in number, forming a loose meshwork among the cells. Elastic fibers, generally present in other loose connective tissues, are not found in the pulp.

The ground substance of the pulp exists in a different physiochemical state, as seen grossly when the vital pulp is extirpated from the pulp chamber and pulp canals. The pulp tends to maintain its shape when removed from its dentinal support, whereas loose connective tissue collapses. Engel,[1] in studies of the nonfibrillar ground substance of connective tissues, describes it as carbohydrate-containing protein of varying states of aggregation, the denser tissues such as bone and dentin being more highly aggregated. Engel speaks of the ground substance as existing in two phases, one which is water soluble and another which is insoluble in water. The relative amounts of these two phases vary in the different tissues and in the same tissue under different physiologic or pathologic conditions. Engel's studies help to explain the gelatinous state of the pulp as compared to loose connective tissue, and also the variation of staining observed in the ground substance of the pulp in some experimental conditions.[2,3]

In the peripheral pulp (Fig. 1, right) the cells are not evenly distributed. On the outer border of the central pulp, young fibroblasts tend to be crowded into a layer called the "cell rich zone." Just beyond the latter there is the "cell poor zone" or Weil's layer. This layer usually contains very few cells and is composed principally of reticular fibers and a nerve plexus. It is in this layer that the very fine nonmyelinated nerve fibers anastomose to form a plexus with branches running peripherally and centrally. Much controversy still exists regarding the exact course and destination of the nerve fibers of the pulp. More knowledge is needed on the type and physiology of these nerves during the life of a tooth. Peripheral to the "cell poor zone" is the odontoblastic layer where the pulpal cells are differentiated into a columnar type distinct from all other connective tissue cells of the body. In the young human erupted tooth most of the cells in this layer exist as mature odontoblasts with a few young odontoblasts scattered among them (Fig. 2, left). The proportionate number of these cell types varies in different animals.[4] The stages of differentiation of these cells from preodontoblasts and young odontoblasts into the mature form as observed in developing human teeth (Fig. 3) are also seen under conditions of repair.[5] These cells have many processes but the terminal process extends peripherally and becomes embedded in the dentin. At the dentinoenamel junction there are at least 15,000 processes per square millimeter of dentin, and that number increases fourfold toward the pulpal junction.[6] It is these terminal cytoplasmic processes embedded in dentin that make operative dentistry so intimately related to the vitality of the pulp. The cell body, or perikaryon, of the odontoblast, lying in the odontoblastic layer, transmits the peripheral stimuli received by its terminal process to the rest of the pulp.

In the odontoblastic layer between the

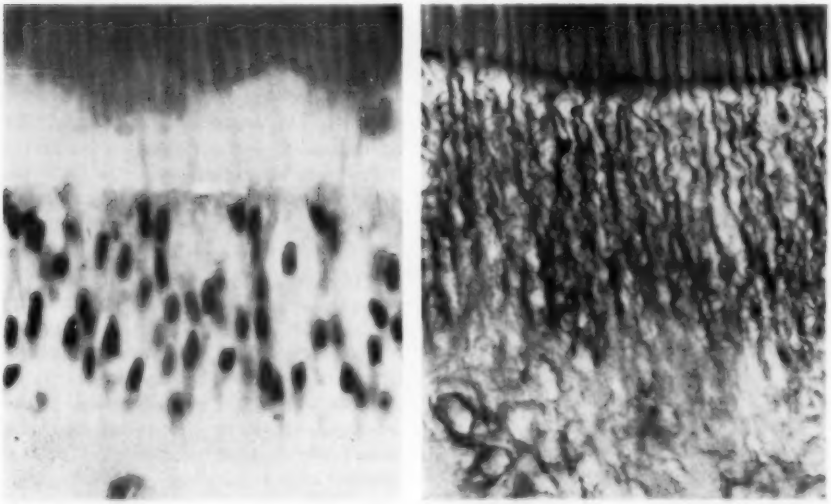

Fig. 2 • Left: Odontoblastic layer in relatively undisturbed region of pulp in young human tooth, showing normal distribution of a few young cells among mature odontoblasts. Right: Region in odontoblastic layer, showing characteristic arrangement of argyrophilic fiber bundles, Korff's fibers, as they spiral upward toward predentin. Silver-impregnated specimen

cell bodies of the odontoblasts, the reticular fibers collect in coarse bundles from the "cell poor zone" below and spiral upward toward the predentin (Fig. 2, right). These fiber bundles are known as Korff's fibers. Capillaries are also seen running through this layer. Separating this layer from the predentin is a thin, continuous membrane, the pulpodentinal membrane[7] (Fig. 1), which appears to remain intact as long as the odontoblasts are not injured. If the odontoblasts, even at their most peripheral extensions, are injured, the pulpodentinal membrane appears disrupted; but once the cells fully recover from the injury, the membrane reappears in a continuous line. More studies are needed before the exact nature of this membrane is understood. As Langeland[8] has pointed out, many variations of this as well as other pulpal structures have confused understanding of what is a normal pulp. Some of these variations may be considered as artifacts produced during the processing of the specimens.

As the pulp ages, the cells tend to decrease and the fibers increase in number. With fewer undifferentiated cells available for emergencies, the defense and repair processes are slower in getting started. The odontoblasts, after the initial deposition of primary dentin, do not completely halt their activity. The deposition of dentin continues, but at a greatly reduced rate. This continued deposition of dentin is reflected in the wider dentinal wall and the smaller pulp chamber of the older tooth.

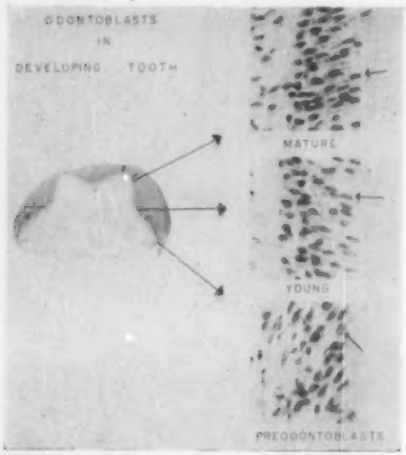

Fig. 3 • Odontoblasts in different regions of a developing human tooth, showing various stages of differentiation of most of the cells in the respective regions

PULPAL CALCIFICATIONS

The propensity of the pulp tissue to form calcified tissue is not limited to its outer layer of cells, the odontoblasts. Pulpal calcifications are seen in the central portion of the pulp and range from minute discrete particles to large occluding and embedded pulp stones (diffuse calcifications and true and false denticles). These calcifications are seen in unerupted and erupted, deciduous and permanent, and young and old pulps. Hill[9] in 1934 found that pulp stones occur in 66 per cent of all teeth of persons between 10 and 20 years of age. James and Schour[10] in 1957 found in the same age group 57 per cent in experimentally treated teeth and 52 per cent in untreated teeth. Pulpal calcifications of the type which occurs in young pulps are naturally more frequent in older pulps.

INFLAMMATION AND SECONDARY DENTIN FORMATION

Whenever external influences reach the dentin, the odontoblastic processes transmit the stimuli to the cell bodies in the odontoblastic layer where, in turn, the pulp tissue responds in a manner typical of other connective tissues—by inflammation. Inflammation is the classical defense mechanism of connective tissues and should be considered under its broadest range from the vascular changes of

hyperemia, diapedesis, hemorrhage and edema to the infiltration of macrophages and leukocytes in both acute and chronic types. The degree of inflammation is related to the intensity and duration of the external influence and the successful activity of the pulpal cells. The resolution of this process determines the fate of the pulp.

Concomitant with the inflammatory response is the reaction of the odontoblasts. After the formation of the primary dentin, the odontoblasts are less active except when external stimuli initiate, in some manner, more rapid production of dentin, the so-called irritation or secondary dentin. An example of this response is seen in underlying areas of attrition. In pulpal horns where cusps have been worn down during normal occlusal function, the subjacent odontoblasts work more rapidly to lay down dentin to compensate for the attrition. This localized activity of the odontoblasts also is seen under regions of gingival erosion and under slow carious attacks. If the external stimulus is rapid and severe enough to destroy many of the underlying odontoblasts, the pulp tries to replace them by moving to the region young cells which have the potential to differentiate into cells capable of laying down dentin. The type and severity of the original irritation and subsequent inflammatory response influence the regenerative or reparative activity of the odontoblastic layer. The inflammatory and odontoblastic responses are therefore intimately interdependent and are equally important criteria for evaluating the pulpal reaction.

CODING INFLAMMATION AND SECONDARY DENTIN FORMATION

The reaction of the pulp to external stimuli is thus reflected in two broad processes: inflammation (I) and secondary dentin formation (D). The many variations of each process have contributed to the difficulty of correlating the various experimental studies. We, therefore, attempted to denote gradations of these two processes in order to facilitate comparisons of the results of the various experimental pulpal studies we had conducted. For the sake of convenience, this method of evaluation will be referred to as the ID index. Kramer and McLean[3] in 1952 were among the first to use a quantitative evaluation of pulpal changes to filling materials. With the use of plus signs they indicated the degree of infiltration of inflammatory cells in the odontoblastic layer and in the pulp other than the odontoblastic layer. They used plus signs to indicate the different amounts of secondary dentin and also used aspiration of the odontoblasts as one of the criteria for evaluating pulpal disturbances. The degree of disturbance by aspirated odontoblasts was also indicated by plus signs.

Rather than consider aspirated odontoblasts or nuclear debris as a separate criterion, we have included it in the broad range of inflammation. We graded the latter according to its location or extension, regardless of localized quantities or type. We designated absence of inflammation with no disturbance of the odontoblastic layer as I^0; the involvement of the odontoblastic layer only, including aspiration of nuclear debris, as I^1; extension of the inflammation to the subodontoblastic layer as I^2; and involvement of the central pulp as I^3.

We graded secondary dentin formation, D, on the basis of the amount formed. It must be pointed out that the amount and quality of secondary dentin depend on the factors of rate and time.[11] Absence of secondary dentin formation in view of destruction of odontoblasts (with the concomitant calcification of predentin which had stopped forming) was coded as D^{-1}; a normal-appearing odontoblastic layer with a normal width (20-30 microns)[12] of predentin as D^0; a slight amount (35-60 microns) of sec-

ondary dentin formation as D^1; a moderate amount (60-90 microns) as D^2; and a considerable amount (90-250+ microns) as D^3. The foregoing coding is not proposed as a substitute for the detailed study of the specific histologic alterations which is necessary to understand the intricate pulpal reactions, but we have found it useful in getting a broad perspective of the biology of the pulpal responses to many different physiologic, clinical and experimental stimuli. It is hoped that a more adequate method of evaluation will become available.

EXPERIMENTAL STUDIES AND APPLICATION OF ID INDEX

In attempting to understand the biology of the pulp more completely, we looked for biological answers to the following specific questions which we hoped to be able to clarify by conducting appropriate experiments on human teeth:

1. What is the range of the pulpal response as demonstrated by inflammation and secondary dentin formation?
2. What is the sequence of events in the pulpal response?
3. What is the pulpal response to the cutting of dentin alone without the influence of a filling material?
4. What is the influence of cavity depth on the pulpal response?
5. How does age affect the pulpal response?

In order to reduce the variables as much as possible, the same group of investigators conducted the experimental procedures, carried out the histological

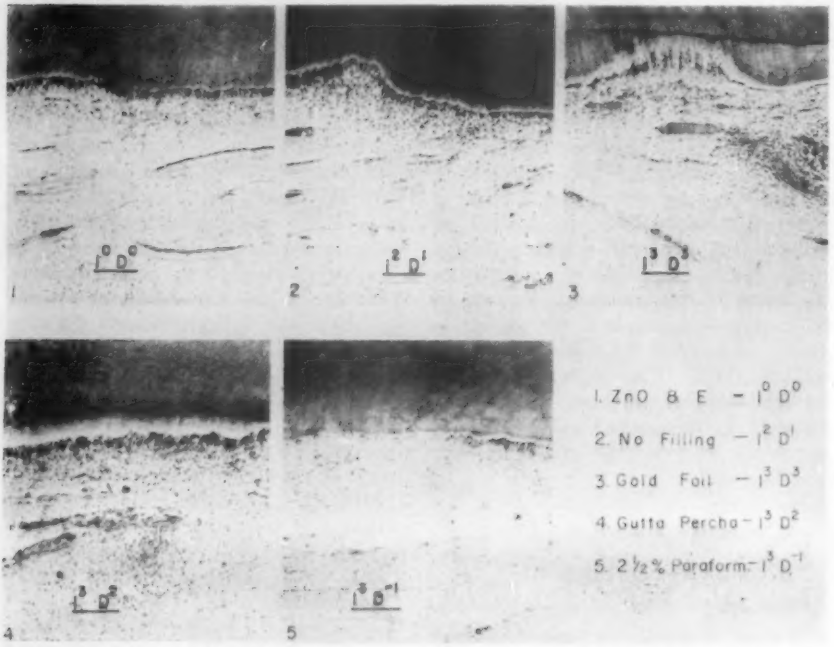

Fig. 4 • Application of ID index to pulpal response of human teeth subjected to cavity preparation and the corresponding filling materials for three to four weeks or longer. Specimens are arranged in sequence of their biological acceptability.

preparations and made the histological evaluation. Cavity preparation and filling materials were used as the exciting factor, and different methods were designed according to the problems to be investigated. Altogether, 166 human noncarious teeth were studied, mostly from orthodontic patients (158 from 11 to 25 year old persons and 8 from 44 and 45 year old persons). The extractions followed the operative procedures in periods ranging from 15 minutes to one year. The details of the operative procedures and histological technics of preparation have been described elsewhere.[12] We learned many interesting and illuminating details from each study, but found the ID index especially helpful in making a general comparison of the broader responses of each experimental group.

Range of Pulpal Response • In order that the range in the pulpal response might be studied, the following filling materials were used: gold foil, gutta-percha, 2½ per cent paraformaldehyde and zinc oxide and eugenol. The experimental material designed to test the effects of cavity preparation without the placement of a filling was also included. The results from the three to four weeks or longer periods were used and the other variables were kept constant; a grading was arrived at and arranged in order of biological acceptability (see Fig. 4).

Sequence of Events in Pulpal Response • The sequence of inflammatory responses and secondary dentin formation was studied in the specimens extracted at different intervals from 15 minutes to one year after the operative procedures. Because of some variation of intervals in the different groups, the responses were grouped for the first week, second week, third to fourth week, and longer periods. These longer periods indicated that the inflammation did not tend to increase after the fourth week but was either stabilized or resolved according to the particular procedures. The amount of dentin varied generally according to the time which had elapsed since the operative procedure. The first appearance of secondary dentin usually was observed approximately in the two week period after the operative procedure. However, variations from this were related to the extent of inflammation. Using our ID index, we found that the sequence of pulpal responses was as indicated in the table.

Table • Sequence of pulpal responses

Filling materials	ID index at survival periods			
	1st wk.	2nd wk.	3-4 wk.	Longer
ZnO & E	$I^{2 \text{ to } 3}\ D^{0}$	$I^{1}\ D^{0}$	$I^{0}\ D^{0}$	—
No filling	$I^{1 \text{ to } 2}\ D^{0}$	$I^{2}\ D^{-1}$	$I^{2}\ D^{1}$	—
Gold foil*	—	$I^{3}\ D^{1+}$	—	$I^{3}\ D^{3}$
Gutta-percha	$I^{1 \text{ to } 2}\ D^{0}$	$I^{3}\ D^{1}$	$I^{3}\ D^{2}$	$I^{3}\ D^{2}$
2½% paraform.	$I^{2}\ D^{0}$	$I^{3}\ D^{0}$	$I^{3}\ D^{-1}$	$I^{3}\ D^{1}$

*Only four specimens were available, but reactions were similar to those in dogs.

Pulpal Response to the Cutting of Dentin • In an effort to separate the influence of the filling material, the following approach was planned: A shallow Class V (labiogingival) cavity was prepared with a central, deeper well. A gold foil plate was adapted over the well and the entire cavity was then sealed with zinc phosphate cement. This left the central deeper well unfilled but sealed off from the outside. It was considered, therefore, that the underlying pulpal response would be to the cutting procedure without the influence of a filling material. The details of the inflammatory response indicated, however, that we had merely substituted another type of environmental change. The ID index for the cavity preparation with no filling was $I^{2}\ D^{1}$. This response may be explained on the basis that the unfilled cavity became exposed to a different pressure from that of the underlying pulp.

Influence of Cavity Depth on Pulpal Response • It was found that regardless of clinical efforts to prepare cavities of uniform depth, microscopic studies showed different proximities of the cavity floors to the pulp, as measured along the course of the cut tubules. Although most of the preparations extended into the middle third of the dentinal wall, there were sufficient numbers with the cavity floor extending into the outer third or into the pulpal third to permit a comparison of the effect of different depths. The intensity of the inflammation tended to vary in direct relation to the depth of the cavity. The deeper the cavity, the greater was the extension of the inflammation. The stimulus for dentin formation tended to be dependent on the inflammatory picture. When the inflammatory response was mild there was a tendency for a limited amount of secondary dentin formation or none. If inflammation was extensive, secondary dentin formation was retarded or minimal. The ID index for these findings would be: shallow cavities = $I^1\ D^1$; medium cavities = $I^2\ D^2$; deep cavities = $I^3\ D^1$.

Age Influence on Pulpal Response • For a determination of the influence of age on the pulpal response, eight teeth from older persons (44 and 45 years of age) were used in the gutta-percha series and compared with 49 teeth of younger persons (11 to 25 years of age). The inflammatory response of the older persons was slightly more extensive and the secondary dentin formation was slightly less than in the younger persons. The ID index for these results would be: medium cavities — gutta-percha (young pulps) = I^2D^2; medium cavities — gutta-percha (old pulps) = $I^{2+}D^1$.

On applying the ID index to nonexperimental physiologic and pathologic conditions of the pulp throughout the life of a tooth, we found the following approximations:

Physiologic condition

Young, erupted, untreated, noncarious tooth = $I^0\ D^0$

Young tooth with attrition = $I^{0\text{ to }1}\ D^{1\text{ to }3}$

Old tooth with attrition = $I^{0\text{ to }1}\ D^1$

Pathologic condition

Young tooth with gingival erosion = $I^0\ D^{1\text{ to }2}$

Old tooth with gingival erosion = $I^1\ D^1$

Young tooth with slow caries = $I^1\ D^{1\text{ to }3}$

Young tooth with rapid caries = $I^3\ D^{-1}$

SUMMARY

The biology of the pulp was considered in terms of its histophysiology and of its experimental response. The structural elements and physiology of the pulp were compared and contrasted with loose connective tissue. A method of evaluating its two characteristic responses, inflammation (I) and secondary dentin formation (D), was proposed as an ID index to facilitate comparisons. This ID index was applied to various experimental procedures as well as nonexperimental physiologic and pathologic conditions.

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Pulp response to restorative materials

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Silicate and copper cements are injurious to the pulp. Other cements, although not so injurious, may be destructive when used close to the pulp. A calcium hydroxide liner always should be placed between cement and the dentin. Acrylic restorations are injurious to the pulp because of marginal leakage, and metal restorations because of thermal conductivity. A base should be used under metal restorations.

It is impossible to do restorative dental work without eliciting a pulp response. The time has passed when restorative dentistry could rely on empiricism. New restorative procedures and new materials must undergo biological tests before they are acceptable to the dental profession. During the past 20 years a large body of knowledge has accumulated on the subject of the effects of operative procedures and filling materials on the dental pulp. Most of this knowledge has come from studies that are experimental in nature. They make use of various experimental animals and also of human teeth. Histological technics are utilized as part of the experimental set-up. Unfortunately, the histological technic shows only the condition of the dental pulp during the one second when the tooth is removed and placed in the fixative for preparation and study. In other words, this experimental method does not tell anything about the immediate pulp response, nor does it tell whether the pulp response might have changed, for better or for worse. To overcome this, most studies on pulp response now make use of the technic of removing teeth at different time intervals after the restorative procedure. A tooth or a number of teeth are removed for study soon after the restorative material has been placed; others are removed some days later; and still others, some weeks later—the longest interval usually being three months or more. The reason for the three-month interval is that the pulp usually can recover from injury in this period. If the pulp has not recovered in that time, it is good evidence that it would eventually have succumbed.

Any discussion of pulp response to restorative materials must take into consideration two other difficulties inherent

in the experimental methods used. One of these is the difficulty of differentiating the pulp response to the cavity preparation from the response to the restorative material. The reason for this is obvious —a restorative material cannot be placed without first subjecting the dentin to injury from cavity preparation. The second difficulty is the inability to ascertain the status of the pulp before cavity preparation and insertion of the restorative material. This difficulty, too, becomes obvious when it is realized that in practice only teeth that are carious or have other lesions are subjected to restoration. Caries and other lesions elicit, by themselves, a pulp response, superimposed upon which is the pulp response to restorative materials.

To overcome these difficulties, the experimental method makes use of noncarious, intact teeth for study. Moreover, the investigator must be familiar with the studies that have been conducted on pulp reaction to various methods of instrumentation without the use of restorative materials, or at least those that are known to be injurious to the dental pulp. The pulp response to any injury is inflammation. It is difficult with the methods described to evaluate degrees of inflammation. Yet, the degree may make the difference between recovery of the pulp and pulp death.

PULP RESPONSE TO INDIVIDUAL MATERIALS

Cements • Pulp response to silicate and copper cements[1-10] is severe inflammation which usually leads to abscess formation and, possibly, necrosis of the dental pulp. The pulp response to zinc silicate and zinc phosphate is similar to that to silicate and copper cements but less severe. There is very little inflammatory pulp response to zinc oxide and eugenol cements.

The reason for the irritating effects of the cements is that the liquid which is used contains as its main ingredient phosphoric acid. Studies using radioisotopes to label the phosphoric acid have shown that it penetrates the dentin from the cement to the pulp. Pulp injury due to this cause is no longer a problem; many studies have now shown that liners containing calcium hydroxide in various combinations protect the pulp from the injurious effects of the cements. The calcium hydroxide in these liners neutralizes the phosphoric acid before it reaches the pulp. *Accepted Dental Remedies*, compiled by the Council on Dental Therapeutics of the American Dental Association, lists two such liners containing calcium hydroxide. The first is a chloroform solution of a resinous material in which the calcium hydroxide is suspended. This material was for many years marketed in a wide-mouthed bottle. As a result, its shelf life was limited and many dentists became disgusted because it dried up in a relatively short time. This material is now available in tubes which come sealed and have only a small, needle-size opening when in use; its shelf life is now excellent. The other material has calcium hydroxide suspended in an aqueous methyl cellulose solution. Both materials have been adequately tested by several authors and show consistent results in preventing a pulp injury from cements. The first material is Chembar, manufactured by the L. D. Caulk Company; the second material is Pulpdent, manufactured by the Rower Company.

Self-curing Acrylic Resins • In contradistinction to the cements, the self-curing acrylic resins[11-22] do not in themselves contain anything which is irritating to any extent to the dental pulp. Yet several studies have shown an inflammatory pulp response to these materials. This apparent contradiction can be readily explained: The physical properties of acrylic resins rather than any chemical irritant are responsible for the pulp reactions seen under use of these materials. It is well

known that the resin materials undergo severe dimensional changes—some of them as high as 127 ppm. Studies using radioactive tracing materials have shown that the margins of acrylic restorations are penetrated readily by solutions. Massler[6] covered the acrylic fillings immediately after their insertion, with wax, so that they were not in contact with saliva and the oral cavity. In these instances normal dentin was formed and the slight disarrangement of the tubules could be explained as being produced by the cavity preparation. The histological studies by Waerhaug and Zander[20] have shown the discrepancy between the material and the dentin to average .08 mm. They were able to observe, in their sections, cells between the dentin and the filling material. In many instances these were bacterial cells. Obviously, then, if such cells are present and in contact with the dentin tubules, they, rather than the filling material, are responsible for the pulp response; indeed, the pulp response seen under self-curing acrylic resins resembles the response to cavities that have been left open to the fluids of the mouth.

This brings up another general problem on pulp response to restorative materials—namely, that in addition to the chemical make-up of the material, one must take into account its physical properties and the skill of the operator in manipulating the material. None of the restorative materials will completely seal the cavity if such yardsticks as the percolation test, and radioisotopes or dye penetration are applied. So, what has been said here about the self-curing resins also holds true, although to a lesser degree, for all other restorative materials.

Amalgams • Experimental studies have shown a mild inflammatory reaction in the pulp beneath cavities which have been restored with amalgam.[4, 7, 23-25] Within a two-month time a heavy layer of secondary dentin will have formed, sealing off the dentin tubules leading from the pulp to the cavity. Whereas amalgam in itself has little or no irritating effect on the pulp, its conductivity must be taken into consideration. Obviously, metal is a much better conductor than dentin and therefore the possibility of thermal injury must be kept in mind. Therefore, cavities should contain some kind of a base which will operate as an insulator between the metal and the dentin.

This brings up another variable that must be discussed to understand a pulp response to restorative materials. This variable is the depth of the cavity. In regard to amalgam, if the cavity walls are very close to the pulp, the pulp response to thermal injury will be greater than in a shallow cavity. The same holds true for chemical irritants like those responsible for the pulp response to cements. Actually, if a zinc phosphate cement is placed in a very shallow cavity, the pulp response will be so mild that the pulp can readily recover and form a nice layer of irregular dentin blocking the dentin tubules. On the other hand, if little dentin remains between it and the pulp, a severe inflammatory reaction with abscess formation will occur.

Gold • Gold is completely inert as far as the dental pulp is concerned. However, what was stated about thermal conductivity for amalgam obviously also holds true for gold restorations. Except for gold foil, gold restorations are cemented with various cements, including resin cements. In a well-fitting restoration the amount of cement that is in contact with the dentin tubules is so small that it will not elicit an injurious pulp reaction. However, dentists sometimes reduce the bulk of these restorations by removing some of the gold on the inside. In such instances the same precautions that were discussed for cements must be taken.

DISCUSSION

The generalizations presented in this paper are based largely on experiments which have been conducted on the teeth of various animals and humans. There is a decided difference in the pulp reactivity of different individuals and in that of different species of animals. Experiments conducted on dog and rat teeth usually produce a more severe pulp reaction to the materials tested than those conducted on monkey or human teeth. This must be taken into consideration when evaluation is made of studies on pulp response to restorative materials.

The generalizations on pulp reaction to filling materials easily can be applied to the clinical practice of dentistry. Cavity preparation should be as shallow as possible, consistent with the mechanical principles of cavity preparation, whenever sound dentinal tubules must be cut. That part of the pulp which is underneath the deepest portion of the cavity—namely, that region where the lesion had extended deep into the dentin—will already have reacted to the lesion. In that region irregular dentin most likely has been formed, walling off the dentin tubules. Since the shallow part of such cavities will be far removed from the pulp, and the deep part will be walled off by irregular dentin, little further pulp damage can be expected even with the most irritating material. The use of one of the two lining materials mentioned previously, in connection with cements, should be routine practice in every dental office. This will further insure a favorable pulp response to restorative procedures. Finally, in addition to the use of the liners, a cement base to provide better insulation under metal restorations is good practice.

SUMMARY AND CONCLUSIONS

Studies on pulp reaction to filling materials have shown that silicate and copper cements are injurious to the pulp. Other cements are not quite so injurious, but when used close to the pulp and in bulk they also may be destructive. Therefore, a calcium hydroxide liner should always be placed between cements and the dentin.

Acrylic restorations are injurious to the pulp because of marginal leakage. Metal restorations may injure the pulp because of thermal conductivity. Therefore, a base should be used under metal restorations.

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Early human pulp reactions to full crown preparations

Samuel Seltzer, D.D.S., and I. B. Bender,† D.D.S., Philadelphia*

Fifteen human teeth, to be extracted for orthodontic or prosthetic reasons, were prepared for full crowns with rotary instruments at speeds varying from 5,000 to 150,000 rpm. Without further treatment, the teeth were extracted, sectioned and examined microscopically. Full crown preparation of a tooth subjects the pulp to much irritation. Pressure, temperature elevation and vibrations damage the pulp. Pulp reactions were much less severe when the teeth were prepared at speeds of from 50,000 to 150,000 rpm, provided copious quantities of water were used.

The use of cast veneer crowns on natural teeth is becoming more prevalent in dentistry. This is partly because full cast crowns are being prescribed in periodontal therapy when extensive loss of the supporting structures of the teeth has taken place. By being soldered together, full cast crowns afford a means of splinting the remaining natural teeth. There is, likewise, a frequent resort to full crown coverage in mouths where the teeth have suffered a great amount of dental caries, or abrasion or attrition. As a result, there is a type of restorative dentistry known as mouth reconstruction or occlusal rehabilitation, in which some or all of the teeth are prepared for full cast veneer crowns.

Preparation of a tooth for a full cast crown requires skill on the part of the operator. It would also seem that it is a procedure which places the pulp of the tooth in jeopardy.[1-5] To begin with, the enamel, a large quantity of dentin and some cementum of the tooth are removed. This is accomplished by the use of rotary tools revolving at various speeds, or tools which cut with abrasives propelled under pressure, or by means of ultrasonic vibrations. The remaining tooth structure is then compressed with hot modeling compound in some technics. After this, the compound and tooth are chilled in an effort to obtain an accurate impression of the prepared tooth.

The tooth pulp may be subjected to other hazards such as reimpressions, ill-fitting temporary crowns, irritating chemicals and traumatic occlusive action. The

additional effects of all of these on the dental pulp can only be surmised.

REVIEW OF THE LITERATURE

Full crown preparation automatically exposes the dental pulp to the same irritants as those present during ordinary cavity preparation. However, in full crown preparation, practically all the dentinal tubules in the crown of the tooth are exposed, thereby tremendously increasing the possibilities of pulp damage. In addition, there appears to be a distinct, almost linear, correlation between bulk of dentin removed and pulpal reaction.[6] Early damage to the pulp is initiated by injury to the odontoblasts,[7] and this injury is made more severe by increases of pressure, temperature and vibrations. These factors affect the dental pulp, especially when vast numbers of dentinal tubules have been opened.

Effects of Pressure on Dental Pulp • Pressure atrophy is the result of continuous or prolonged pressure on a group of cells. It affects the cells by interference with their vascular or lympathic supply, thereby preventing proper nutriment from reaching and being absorbed by the cells. Pressure atrophy and cell necrosis occur in the dental pulp as the result of operative procedures.

It has been noted[8-10] that pressure from the beaks of the extracting forceps causes destruction of the underlying odontoblasts as well as capillary hemorrhage in the odontoblastic layer. Orban[9] and Kramer and McLean[10] observed also that odontoblastic nuclei were aspirated into the dentinal tubules in regions underlying the points where the blades of the forceps were in contact with the tooth. Significantly, Orban raised the question of

> Whether or not other dental operations, such as cavity preparations, grinding of a tooth for a crown, pounding a gold foil, etc., could produce similar or different injuries in the pulp. . . .

Pressure caused by certain filling materials produces similar odontoblastic disturbances.

We have observed, as have Kramer and McLean[10] and Langeland,[11] that in teeth containing acrylic restorations, there are often areas of dentin adjacent to the cavity preparation in which the odontoblasts are aspirated into the dentinal tubules. This condition corresponds to that seen in teeth extracted with forceps. Our observation raises the question of whether or not the expansion and contraction of self-curing acrylic resins act in the same way as the forceps, causing compression of the dentin and pulp with resultant sucking or pumping action on the odontoblasts.

The investigations of James and Schour[12] indicated that severe pulpal injuries resulted after gold foil was inserted into the cavities of dogs' teeth. They suggested the possibility that the initial injury of the odontoblasts was aggravated by the pressure of the pounding of the gold foil pellets.

Seltzer[8] showed that pressure of the drill run at low speed during full crown preparations caused severe damage to the pulps of the teeth of a dog (Fig. 1). Additional damage occurred when the prepared tooth was subjected to the pressure exerted by a modeling compound impression.

In sections of several human teeth prepared for veneer crowns which were subjected to compression with hot modeling compound, there was profuse hemorrhage into the odontoblastic layer all around the circumference of the pulp (Fig. 2). In addition, erythrocytes and macrophages were found scattered throughout the body of the pulp (Fig. 3).

It must be concluded that combined pressure and heat on the dental pulp can be extremely damaging. In addition, there is a correlation between the two,

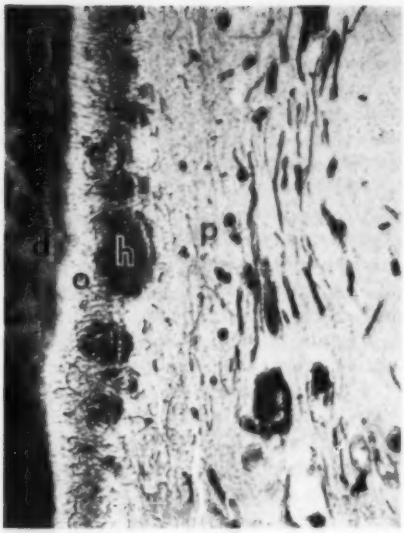

Fig. 1 • Photomicrograph of horizontal section of lower right first molar of dog. Tooth received full crown preparation at 3,500 rpm. Note multiple hemorrhages (h) in region of odontoblastic layer (o). Dentin (d), pulp (p)

greater pressure yielding higher frictional heat.[2-5, 10]

Effects of Heat on the Dental Pulp • A great deal of investigation has taken place to determine whether increases of heat above body temperature occur within a tooth after operative procedures. These studies indicate that elevations of temperatures occur and that severe changes are consequently produced.[13-17] Although this does not necessarily mean that repair will not occur,[18] it is desirable to keep the heat production at a minimal level. Swerdlow and Stanley[19] showed that the pulps of all teeth in which cavities were prepared at 20,000 rpm (both with and without water sprays) exhibited inflammatory lesions. However, the inflammatory lesions in those prepared with water spray were much less extensive than in those teeth which were prepared without spray. This emphasizes the importance of heat reduction. Where full crown preparations are made, even water sprays may not be adequate to control the heat, since the spray may not strike the tooth at the exact point of contact of the bur with the dentin during drilling. This, then, necessitates the use of a generous stream of water on the tooth during the preparation. Langeland[20] has shown that if a cavity is not kept sufficiently wet during preparation, odontoblastic nuclei are aspirated into the dentin. Resultant inflammatory changes are initiated in the pulp.

Effects of Vibrations on the Dental Pulp • Separation of the effects of vibrations from effects of pressure and temperature is difficult, if not impossible. Sonic vibrations are apparently much less destructive than ultrasonic vibrations when applied to the teeth of guinea pigs. Hansen

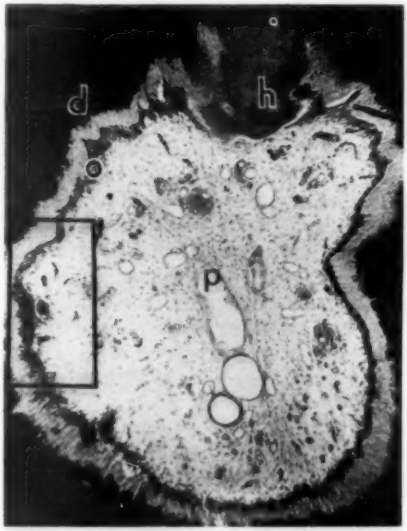

Fig. 2 • Photomicrograph of horizontal section of human upper left first bicuspid of 48 year old man. Tooth was prepared for full crown, and impression was taken with hot modeling compound before tooth was extracted. Multiple hemorrhages (h) in odontoblastic layer (o) around entire circumference of pulp (p). Dentin (d)

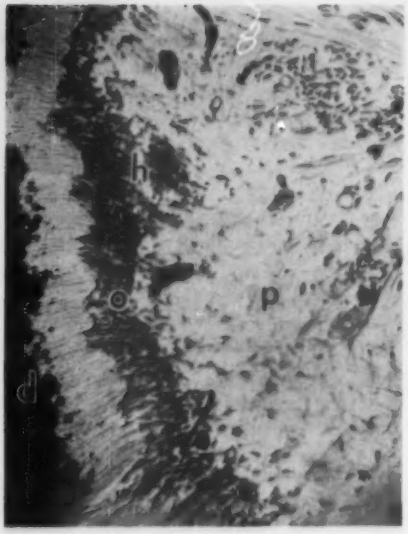

Fig. 3 • Higher magnification of rectangular area in Figure 2. Hemorrhage (h) into odontoblastic layer (o). Scattered erythrocytes and macrophages throughout body of pulp (p). Dentin (d)

and Nielsen[21] and Nielsen and Kennedy[22] compared the tissue responses in guinea pigs in whose teeth cavities were prepared by both rotary and ultrasonic instruments. Disturbances in amelogenesis were found to be more prevalent and more severe in the teeth which were cut with the ultrasonic device than in those prepared by rotary instruments. Severe pulp changes and alterations in dentin formation were not present in teeth which were prepared by rotary methods, but were found in teeth cut with the ultrasonic handpiece.

On human teeth, however, Zach and Brown,[23] Mitchell and Jensen[24] and Healey, Patterson and Van Huysen[25] reported that pulp changes were slight after cavity preparations with an ultrasonic device. The tissue reaction was apparently no more severe than that produced by bur preparations. Friedman, Lite and Solomon[26] arrived at essentially the same conclusions after examining sections of 16 monkey teeth which had been drilled with both ultrasonic and rotary instruments.

Bernier and Knapp,[27] in their investigations of the effects of high-speed instruments on the dentin and pulp of teeth in man and dogs, observed a peculiar lesion in the pulp which they termed the "rebound response." This was a combination of some of the following: A change in the ground substance, edema, fibrosis, odontoblastic disruption and reduced predentin formation. This response was found at a site which was distant and unrelated to the cut dentinal tubules. The investigators suggested the possibility that high-speed instruments introduce ultrasonic energy into the tooth structure, which results in pulp damage.

Walsh and Symmons[28] reported that at speeds of 40,000 to 70,000 rpm produced by a compressed air turbine, teeth could be cut without perceptible vibrations. They claimed that because of the rapid and efficient cutting and absence of pressure, heat generated per unit quantity of tooth substance removed was actually lessened. Presumably, this would cause less pulp damage.

The observations of Swerdlow and Stanley[29] tended to confirm the reports of Walsh and Symmons. They observed that the pulps of teeth cut at 150,000 rpm demonstrated a milder pulp reaction than those which were cut at 20,000 rpm.

PROCEDURE

In order to determine the early effects of full crown preparation on human teeth, we decided to extract the teeth immediately after preparation. This would eliminate the necessity for consideration of the effects of drugs or filling materials on the dental pulp. This is in agreement with the views of Langeland.[20] Accordingly, a series of 15 human teeth, which were to be extracted for orthodontic or prosthetic reasons, were treated. All but two of the patients were

in the 13 to 19 age group. The two oldest patients were 35 and 48 years old. Two teeth were prepared at speeds of 5,000 to 8,000 rpm, 5 teeth at 25,000 rpm, 3 teeth at 40,000 to 50,000 rpm and 5 teeth (including those of the two oldest patients) at 100,000 to 150,000 rpm. The teeth were prepared with rotary instruments. All the teeth were intact and had no history of previous dental caries, restorations or pulp damage. Preparation involved removal of enamel and dentin under a constant stream of water, as would ordinarily be done for a veneer crown preparation. Without further treatment, the teeth were then extracted. The apical third of the root was severed with a diamond disc to allow penetration of the fixative into the pulp. The teeth were then immersed in 10 per cent Formalin, decalcified, sectioned and stained with hematoxylin and eosin for microscopic examination.

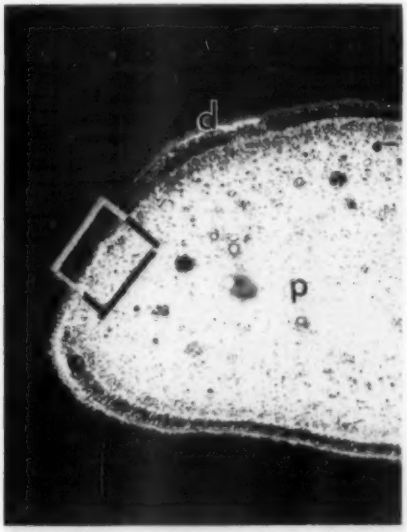

Fig. 4 • Photomicrograph of horizontal section of human upper left first bicuspid, patient aged 14. Full crown preparation at 8,000 rpm. Odontoblastic layer (o) is disrupted and palisade arrangement of odontoblasts is missing. Pulp (p)

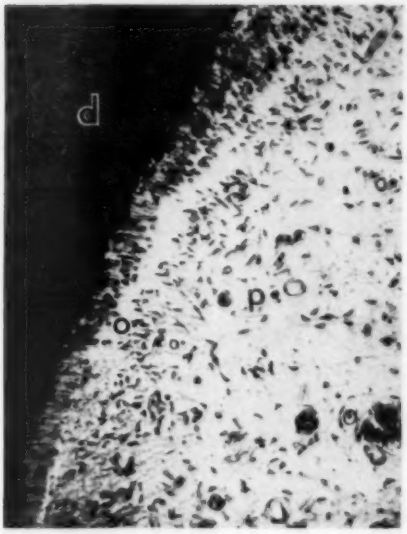

Fig. 5 • Higher magnification of rectangular area in Figure 4. Odontoblasts (o) are missing and many odontoblastic nuclei are found in the predentin. Dentin (d), pulp (p)

FINDINGS

The changes to be described are a composite of the findings in all of the teeth prepared at the same speeds.

5,000 to 8,000 rpm • Two teeth were studied, one each from patients aged 14 and 16. The odontoblastic layer was severely affected (Fig. 4). In several regions, the odontoblasts had been destroyed and cellular debris was present. Many odontoblastic nuclei were found lying in the predentin. For some distance from the region of cell necrosis, there were regions where the normal palisade arrangement had been altered. Here the pulpodentinal membrane was destroyed. Spaces were present between the remaining odontoblasts and the predentin, indicating the presence of edema. Scattered erythrocytes were found between the remaining pulp cells. The deep pulp tissue was relatively normal (Fig. 5).

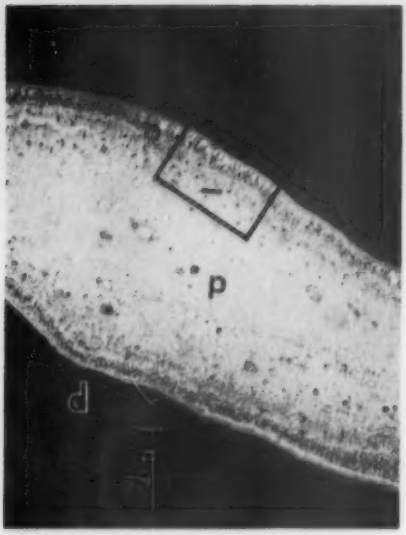

Fig. 6 • Photomicrograph of horizontal section of human upper right first bicuspid, patient aged 14. Full crown preparation at 25,000 rpm. Odontoblasts (o) are disrupted and compressed by fluid. Dentin (d), pulp (p)

25,000 rpm • Five teeth were prepared, four from a patient aged 14 and one from a 16 year old patient.

Alterations from the normal were found in the odontoblastic layer (Fig. 6). The odontoblasts were compressed by fluid in several regions, leaving thin strands of cytoplasm. Fluid had replaced the pulpodentinal membrane in those regions. Mild capillary hemorrhage resulted in the presence of erythrocytes extravascularly, within and below the odontoblastic layer. Blood vessels in the remaining pulp tissue were hyperemic (Fig. 7).

40,000 to 50,000 rpm • Three teeth were studied, one from a 13 year old patient and two from an 18 year old.

Pulp changes were found only in the odontoblastic layer and these changes tended to be confined to a small region (Fig. 8). Normal palisading of the odontoblasts was changed so that the cells were no longer parallel or in continuous contact. A few odontoblastic nuclei were found in the predentin. In this region, the pulpodentinal membrane was destroyed but the edema was not noticeable. The remaining pulp tissue was normal (Fig. 9).

100,000 to 150,000 rpm • Five teeth were prepared at these speeds. Two teeth were in a 12 year old patient and one tooth each was prepared in patients 19, 35 and 48 years old.

The pulp changes were not different in the teeth of the older patients than in those of the younger ones. The odontoblastic layer was affected to only a slight degree (Fig. 10). The alterations consisted of disruption of the normal palisade arrangement in one region and a loss of the pulpodentinal membrane because of slight edema. A few scattered erythrocytes were found within and be-

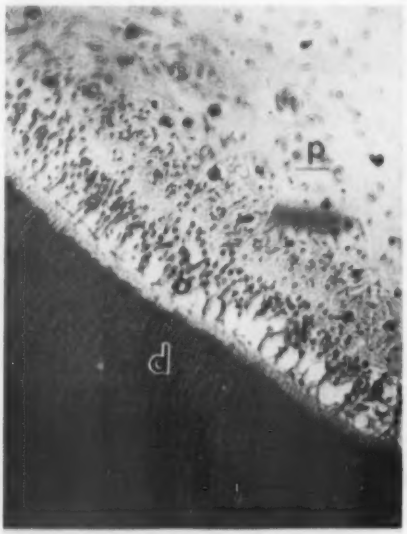

Fig. 7 • Higher magnification of rectangular area in Figure 6. Odontoblasts (o) are compressed and nuclei are pyknotic. Dentin (d), pulp (p)

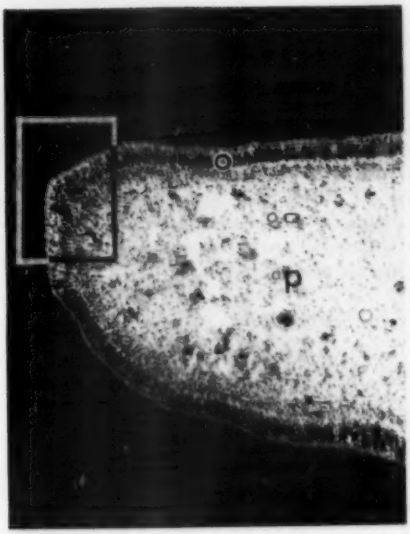

Fig. 8 • Photomicrograph of human upper right first bicuspid, patient aged 13. Full crown preparation at 40,000 rpm. Alterations in odontoblastic layer (o) are confined to one region. Pulp (p)

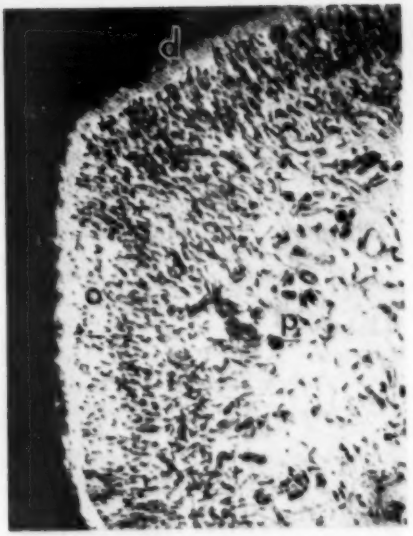

Fig. 9 • Higher magnification of rectangular region of Figure 8. Odontoblasts (o) are disorganized and some nuclei are in the predentin. Dentin (d), pulp (p)

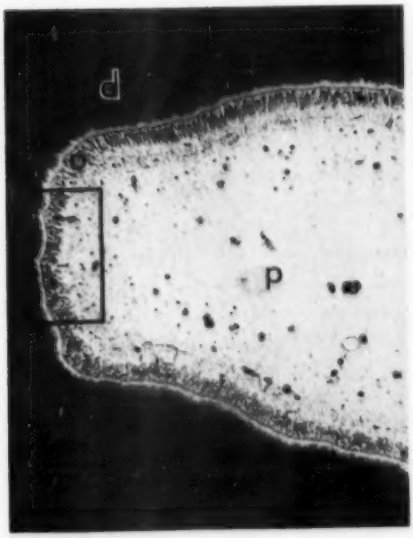

Fig. 10 • Photomicrograph of horizontal section of human upper left first bicuspid, patient aged 12. Full crown preparation at 125,000 rpm. Odontoblastic layer (o) is relatively normal. Dentin (d), pulp (p)

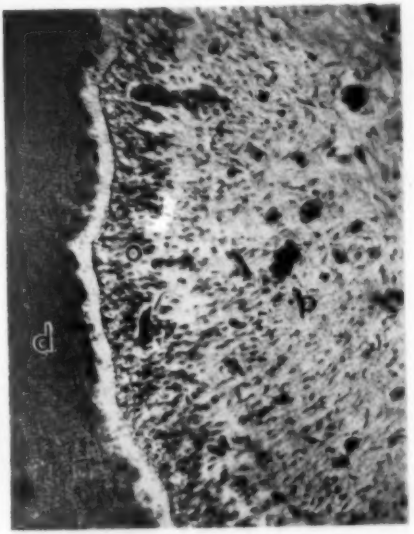

Fig. 11 • Higher magnification of rectangular area in Figure 10. Odontoblasts (o) are affected to a minor degree. Pulp (p) is normal. Dentin (d)

low the odontoblastic layer. The rest of the pulp was normal (Fig. 11).

SUMMARY

Since early pulp changes resulting from full crown preparation tend to be confined to the odontoblastic layer, special attention was paid to this region. It was found that with mild damage, the width of the odontoblastic layer and the arrangement and morphology of the odontoblasts were altered. In some instances, odontoblastic nuclei were aspirated into the dentin. With more severe damage, the pulpodentinal membrane became disrupted by edema and the cells degenerated. Capillaries in the odontoblastic layer became dilated and hemorrhage occurred. The pulp tissue itself exhibited dilation and congestion of blood vessels and hemorrhage. Later pulp changes are initiated by products liberated by the damaged odontoblasts.

Our impressions, based on the limited amount of material studied, were that the pulp reactions were much less severe when the teeth were prepared at higher speeds (50,000 to 150,000 rpm) than at the lower levels (5,000 to 25,000 rpm). However, care must be taken to keep the teeth wet during preparation in order to dissipate heat production. Drying of the tooth is hazardous. We attribute these findings to the reduction of the intensity and duration of the irritants (pressure, temperature and vibrations) at the higher speeds. It must be emphasized, however, that these were not completely controlled experiments in that there was variance among the preparations in such factors as remaining thickness of dentin, preparation time, kinds of burs, discs and stones used and pressures employed in cutting.

CONCLUSIONS

1. Full crown preparation of a tooth subjects the pulp to a great amount of irritation inasmuch as vast numbers of dentinal tubules are exposed.

2. Pressure, temperature elevation and vibrations are damaging to the pulp.

3. Reduction in pulp irritation seems to occur at higher speeds providing that copious quantities of water are used during crown preparation.

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Use of dehydrated pancreas in oral hygiene

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An enzyme powder composed of dehydrated pancreas and a dispersant lactose, applied once daily for six weeks to the teeth and gums with a toothbrush and allowed to remain for 10 to 15 minutes, reduced the amount of calculus about 60 per cent and the amount of inflammation of the gingival tissues by 70 to 90 per cent. The enzyme powder also reduced substantially the time required for scaling of the teeth and was a valuable adjunct in the maintenance of oral hygiene. A review of the literature provides the basis for the use of proteolytic enzymes in supplemental therapy for periodontal disease.

A study has been made to determine the usefulness of dehydrated pancreas in the maintenance of oral hygiene in patients with periodontal disease. The basis for the use of proteolytic enzymes in supplemental therapy for periodontal disease and for the selection of the particular pancreatin used appears later in this paper in the review of the literature.

Preliminary studies were made with dehydrated pancreas (Viokase)[1] to determine its usefulness as a debridement agent in home care of the mouth. In vitro studies were made placing calculus scrapings from teeth in a freshly prepared suspension of the material. Softer and smaller particles of calculus disintegrated, and larger, harder particles softened so that they crumbled under finger pressure. Extracted teeth were examined for defects and placed in a freshly prepared solution of the material. No observable change occurred.

Because of the difficulty of access to the

depth of the gingival crevices and pockets, it was decided to add a dispersant, lactose, to the pancreas powder. This mixture is referred to in this report as enzyme powder.

The results of a pilot clinical study with this material encouraged further investigation.[1] Two hundred and fifty-nine individuals were instructed in the daily home use of the enzyme powder. Within four to six weeks the inflammation of gingival tissues and the amount and hardness of calculi were all reduced. The time required for routine prophylaxis was reduced by a third to a half.

SUBJECTS AND METHODS

The following study was conducted at Deuel Vocation Institution at Tracy, Calif., a state institution of behavior correction. The study was directed primarily toward development of better procedures and training for the maintenance of mouth hygiene. The study served also as a survey of the severity of periodontal lesions among the residents. Less than 5 per cent were free of lesions, 30 per cent had mild lesions, 40 per cent had advanced and 25 per cent had severe periodontal lesions.

On admission to the institution the men were interviewed individually as they presented themselves at the dental department for routine examination. The proposed procedures of the investigation were explained to each and participation was invited. Medical histories were taken in order to rule out instances in which there was obvious physical or psychological impairment. Preliminary dental examinations were made in order to rule out the edentulous and those with no evidence of periodontal lesions. Within these limitations 163 men between the ages of 17 and 23 years were selected at random, and of this number, 134 were carried through the entire study. The study of 29 was not completed because they were transferred from the institution or because their activity schedules were incompatible with the requirements of the study. This report concerns itself with the 134 subjects on whom studies were completed.

The initial examination of each participant included the following:

1. A medical history which included questions about age, race, history of previous illnesses and current state of health within the individual's knowledge. The range in age was 17 to 23 years; 63 per cent were white, 37 per cent colored. No one with severe health problems was accepted.

2. A dietary history recording a review of the individual's habits of food intake within his recollections. No unusual patterns of food intake were observed and all participants had access to the same diet during the study.

3. Full mouth roentgenograms. These were not repeated at the conclusion of the study since roentgenographically significant changes were not expected in the limited interval. The roentgenograms were used to evaluate the extent of involvement at the time.

4. Intraoral color photographs were taken including views of the right and left buccal region, the central labial, central palatal (mirror view), central lower lingual region (mirror view) and one of the tongue. These proved to be a valuable adjunct in the evaluation of data in that they allowed a picture recording of conditions at each examination period. All six views were interesting and helpful; the views of the inside lower lingual region and of the tongue proved to be most valuable.

5. Oral examination was limited to an evaluation of the degree of inflammation of three portions of the gingival tissues, namely the papillae, the free gingivae and the attached gingivae, and to grading the amount of calculus deposit present. The degree of inflammation of the three tissue portions and the amount of calculus were graded from 1 to 5, signifying none,

slight, moderate, severe and extreme evidence of the affliction. This grading system was used in order to provide a ready means of expressing the average or mean degree of severity of the factors evaluated for each group studied.

Two materials were used. One was the enzyme powder and the other a placebo. The enzyme powder was composed of a pancreas substance which is 80 per cent protein and 20 per cent lactose. The placebo substituted lactalbumin for pancreas substance, so it also had 80 per cent protein and 20 per cent lactose. The placebo was similar in physical properties, consistency, particle size, odor, flavor, and so forth to the enzyme powder. The two materials were identified by number, and no one associated with the study had any knowledge indentifying the respective preparations. The numbers and identities of the preparation were filed at the University of California Medical Center in a sealed envelope which was opened after the experiment was terminated.

Each participant was supplied with the same kind of toothbrush and individually instructed in its use as follows:

Eliminate excess of saliva from the mouth; moisten the toothbrush slightly so as to pick up a small amount of powder and apply it to the teeth and gums. Allow it to remain for 10 to 15 minutes and then brush the teeth and gum tissues thoroughly.

The object of the 10 to 15 minute interval beween application of the powder and the brushing was to allow the enzymes to hydrolyze the debris and thus facilitate a more thorough cleansing by brushing. The amount of powder was about 1 Gm. and was described as equivalent in size to that of half of the first joint of the little finger. Emphasis was placed on the importance of careful cooperation. Most of the participants had not practiced adequate daily mouth care previously. They were cautioned to condition the mouth gradually in order to avoid undue discomfort or injury to tissue.

The 134 participants were divided into three groups:

1. Group 1—39 subjects served as untreated controls.
2. Group 2—55 subjects served as placebo controls.
3. Group 3—49 subjects served as the treated group.

For six weeks after the intitial examination was completed, Group 1 continued with no change in daily routine of mouth care, Group 2 used the placebo powder, Group 3 used the enzyme powder, and the evaluations of oral conditions were repeated. Then all three groups used the enzyme powder, and evaluations of oral conditions were repeated at the end of each of two subsequent six week periods. Interpretation of the findings is given with the results.

Time studies were made for scaling of the teeth of each individual in the three groups. The scalings were performed by the same person without knowing which individuals had used the enzyme powder and which had used the placebo.

RESULTS

In the initial examination the evaluation of oral conditions was similar in the three groups (see the table). After six weeks Group 1 with no change in mouth care showed virtually no change. Group 2 using the placebo showed some improvement which could be attributed to better use of the toothbrush. Calculus was reduced about 12 per cent, inflammation of papillae about 20 per cent, free gingivae about 15 per cent and attached gingivae about 55 per cent. In Group 3 using enzyme powder there was considerably more improvement. Calculus was reduced about 60 per cent, inflammation of papillae about 70 per cent and inflammation of the free and attached gingivae over 90 per cent. After 12 weeks Groups 1 and 2 having used enzyme powder for six weeks showed improvement similar to that of Group 3 in the first six weeks.

Table • Clinical evaluation of oral condition

Group	Number of subjects N	Initial examination: Method of mouth care	Calculus M	Inflammation of: Papillae M	Free gingivae	Attached gingivae	After 6 weeks: Method of mouth care	Calculus	Inflammation of: Papillae	Free gingivae	Attached gingivae
1	30		2.70	2.73	1.63	.47	No change in daily care	2.70	2.73	1.63	.47
2	55		2.34	2.49	1.54	.53	Daily use of placebo	2.70	2.00	1.33	.25
3	49		2.59	2.63	1.65	.28	Daily use of enzyme powder	1.02	.73	.08	.00
		After 12 weeks					After 18 weeks				
1	30	Daily use of enzyme powder	1.23	1.13	.37	.03	Scaling followed by daily use of enzyme powder	.23	.16	.0	.0
2	55		1.14	.99	.27	.04		.18	.13	.02	0
3	49		1.05	.77	.14	.03		.10	.095	.0	.0

Results of time studies on scaling of teeth showed that scaling of 55 subjects after using the placebo for six weeks required an average time of 36.2 minutes and that of 82 subjects after using the enzyme powder six weeks required an average of 24.8 minutes. An average of 11.4 minutes (almost 46 per cent) more time was required to scale teeth of patients using the placebo.

DISCUSSION

The cooperation of the entire staff and all participants of this study was so outstanding as to deserve special comment. The use of an adequate toothbrush accomplished a great deal of benefit quite independent of what was used on the brush. Furthermore, the use of enzyme powder once a day in addition to usual mouth care was a valuable adjunct in improving oral hygiene. In almost every instance the individual was immediately aware of the benefit, so much so that he was encouraged to continue treatment.

No unfavorable local or systemic effects were observed. In addition to the investigation reported here, the author has routinely examined 54 adult patients every four months who have used the enzyme powder once daily for four years. There have been no unfavorable side effects to soft tissue or to tooth structure with the exception that a slight sensitiveness of the soft tissue was occasionally experienced. This was due to using an excessive amount of the powder, and the individual soon learned to adjust to the amount indicated.

The ideal amount varied somewhat between individuals, but usually was about 1 Gm.

Olinger[2] using topical applications of solutions of crystalline trypsin reported improvement in the degree of inflammation of the soft tissues but not change in calculus deposits. In this study definite effects on calculus were observed. This may be due to the fact that the enzyme powder was not an extract but the whole pancreas containing all the enzymes of

the pancreas including not only trypsin but also chymotrypsin, carboxypeptidase, amylase, lipase, nucleases, elastase and esterases. Studies have shown that this pancreas powder contains much more carboxypeptidase, elastase, esterases and other enzymes than other pancreatic preparations.[3] The effects of all the enzymes of the pancreas supplement each other. They exert important effects in hydrolyzing carbohydrates and fats as well as proteins. It may be wrong to attribute the effects of this enzyme powder, which is desiccated, defatted whole pancreas, to proteolytic enzymes alone, for in debridement it has a wide range of effectiveness.

REVIEW OF THE LITERATURE

A review of the literature indicates that proteolytic enzymes are being more and more widely used in debridement of necrotic and purulent lesions. Such lesions have in common debris composed of broken-down protein material which in itself is toxic and which supplies a substrate favorable for bacterial growth. It has been shown[4] that topically applied, proteolytic enzymes hydrolyze dead cells without harming live cells, reduce debris and promote tissue repair.

John Hunter probably was the first to demonstrate the digestion of dead tissue by animal proteolytic enzymes.[5] However, not until the last two decades has the activity of such substances on the tissues of man been studied. Since then streptokinase and streptodornase, trypsin, chymotrypsin and pancreatin have been shown to have beneficial effects in the treatment of necrotic and purulent lesions. Streptokinase and streptodornase derived from cultures of hemolytic streptococci have been used effectively in the treatment of chronic ulcerative lesions.[6] Solutions of streptokinase and streptodornase have been introduced into the thoracic cavity with therapeutic effects on fibrinous or purulent exudations in loculated postpneumonectomy, hemothorax, traumatic hemothorax, sterile loculated empyema, and bacterial empyema.[7] Concentrates of these materials were applied directly to local infections and miscellaneous chronic ulcerative lesions. Streptokinase and streptodornase have been used in solutions or in lubricating jelly as an ointment in 53 instances including compound fractures, ulcers in peripheral vascular disease, infected amputation stumps, frostbite with gangrenous digits, osteomyelitis and pleurisy.[8] Results were good in 48 instances, there were no effects in 5 remaining instances and no systemic reactions to local use.

Trypsin has been used successfully in the treatment of burns.[9] Pure crystalline trypsin has also been used to treat fibropurulent empyema.[10] When wet dressings of trypsin (250,000 units in 25 cc. diluent) were applied three times a week to open wounds, separation of slough tissue that would have required months to complete by former methods was achieved in one week.[11] This idea was carried further to inhalation therapy. Trypsin (50,000 to 800,000 units) in solution aerosols was given every 24 hours.[12] This was a safe, effective means of promoting bronchial cleansing, and allowed patients to rid themselves of accumulating infectious and toxic debris. Powdered crystals of trypsin have been applied directly to chronic surface ulcers resistant to conventional surgical management, with highly satisfactory results.[13]

Trypsin both in powdered crystalline form and dissolved in buffered solution has brought about resolution of a wide variety of lesions such as tuberculous empyema, grossly contaminated amputation stumps, subcutaneous hematoma, chronic osteomyelitis, diabetic gangrene, sloughing wounds after failure of skin graft, and varicose ulcers.[4, 5, 14] Surface application of trypsin had no undesirable side effects, tryptic debridement denied bacteria purulent secretions as a culture medium, and tissue repair was acceler-

ated. The investigators stated that "only necrotic tissue is removed, that even the tiniest island, indeed a single living cell will be spared by tryptic debridement." Chymotrypsin complemented the effectiveness of trypsin by 200 per cent when the two were used together as debridement agents.[4] This revealed the advantages of using other proteolytic enzymes along with trypsin.

According to all reports, proteolytic enzymes have effectively eliminated suppurative, necrotic purulent debris, deprived bacteria of purulent secretions needed as a culture medium, promoted healing and have had no unwanted side effects.

Recent investigations emphasize the importance of endogenous tissue toxins and the self-perpetuation of inflammation. A new experimental technic permits the consistent reproduction of a focal syndrome typical of focal infections.[15] Female Sprague-Dawley rats which were unilaterally nephrectomized and placed on 1 per cent sodium chloride as drinking fluid and which received daily injections of a contaminated protein consistently produced a classical focal syndrome within 10 to 15 days. Putrified proteins themselves were of major importance as causative agents, showing the truth of the observation of Pasteur, "The microbe is nothing, the soil is everything." Whatever the cause of the initial injury to tissue—physical, chemical, thermal or bacterial—inflammation resulted.[16] Broken cells emitted toxic substances and these in turn injured more cells. A chain reaction of cellular destruction was started and endogenous toxins were built up. This self-perpetuating characteristic of inflammation is a race between the vulnerability of cells to self-destruction through their toxins and their ability to defend themselves.[17]

Detoxification of the endogenous toxins of broken cells breaks the chain reaction of cellular destruction. Thus debridement may be a major factor in the treatment not only of the necrosis and the purulence of a lesion but of inflammation as well.

Debris in the mouth has long been recognized as an important factor in the cause of periodontal disease. Slough cells from normal healthy soft tissues of the mouth accumulate enough each day to constitute an important element of oral debris, and if the debris is not removed, microorganisms of the oral cavity increase over tenfold.[18]

Bacterial organisms relevant to periodontal disease may increase as a result of the underlying condition rather than cause it,[19] but these organisms may also account for part of the inflammatory reaction and increase tissue permeability for the diffusion of toxic substances in gingival crevices and pockets.[20]

Debris and bacteria may also participate in calculus formation.[21] The relation of gingival tissue to the teeth forms the gingival crevice, and this crevice is vulnerable to progressive complications of pocket formation. Gingival tissues have a proclivity for persistent inflammatory reaction. Calculus, bacteria, inflammation and debris must all be dealt with in the treatment of periodontal lesions.[22]

Thus debridement constitutes an important part of treatment of periodontal disease, and proteolytic enzymes have been used with success for this purpose. In enzymatic debridement of periodontal lesions crystalline trypsin dissolved in a buffered solution was applied in 32 instances to affected regions with saturated cotton dressings for from five minutes to three hours.[2] Slough and necrotic debris were removed within 10 to 20 minutes with no alteration of tooth structures and no undesirable systemic or local effects. Inflammation was reduced and tissue repair was accelerated. Caries and calculus were unaltered.

These favorable results of local wet applications of trypsin to affected regions of the mouth in periodontal disease suggested that a substance containing proteolytic enzymes might be beneficial in sup-

plemental therapy if the substance were in a form suitable for daily application. The observation of a great improvement in debridement by the addition of chymotrypsin to trypsin further suggested that a combination of proteolytic enzymes might be more effective than extracts of trypsin alone. Dehydrated pancreas seemed to have these qualifications and the qualities of a particular pancreatin suggested itself as being most suitable. Whole raw pancreas is desiccated and defatted in a closed system avoiding losses by heat and oxidation. The powder remains stable and retains all of the proteolytic activity of the pancreas.[23] A number of investigators[1, 3, 24-34] have reported favorable results with its use. It contains trypsin, chymotrypsin, carboxypeptidase, amylase, lipase and nucleases.[24] Its total proteolytic activity is high, hydrolyzing 108,000 times its own weight of gelatin. In a trial of various preparations of pancreatin in substitution therapy on patients who have undergone total pancreatectomy, this one was found to be more effective than other preparations of pancreatin and its use resulted in none of the untoward gastric symptoms usual in other substitution therapy.[32]

SUMMARY AND CONCLUSIONS

One hundred and thirty-four subjects were studied to determine any possible benefit from the use of dehydrated pancreas (Viokase) in the maintenance of oral hygiene. They were divided into three groups. Thirty-nine subjects were untreated controls, and no change was made in their routine of mouth care. Fifty-five used a placebo and 49 used an enzyme powder once each day. The enzyme powder was made up of dehydrated pancreas (Viokase) and lactose as a dispersant.

After six weeks the untreated controls showed no change. The placebo controls showed some improvement which could be attributed to an improved use of the toothbrush. Calculus was reduced about 12 per cent, inflammation of the papillae, free gingivae and attached gingivae was reduced about 20 per cent, 15 per cent and 55 per cent respectively. Those using the enzyme powder showed considerably more improvement. Calculus was reduced about 60 per cent, inflammation of papillae, free gingivae and attached gingivae was reduced 70 per cent, 90 per cent and 90 per cent respectively.

After 12 weeks the untreated controls and the placebo controls were switched to enzyme powder. Six weeks later they showed improvement similar to that of subjects using the enzyme powder in the beginning.

The teeth of 83 subjects were scaled after six weeks' use of the enzyme powder, the average time required being 24.8 minutes. The scaling of the teeth of 55 subjects after six weeks' use of the placebo required an average of 36.2 minutes or almost 46 per cent more time.

An enzyme powder composed of dehydrated pancreas and a dispersant lactose, used once daily in addition to the usual routine of mouth care, reduced the amount of calculus deposits and the amount of inflammation of the gingival tissues. It also reduced the time required for scaling of the teeth and was a valuable adjunct in the maintenance of oral hygiene.

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Assets of the Scientist • In the self-scrutiny to which we are brought by the inescapable force of events, scientists and engineers possess, more immediately than any other professional group, two very great strengths. In the first place, our professional activities enrich us as a group with a greater frequency and a greater range of contact and collaboration with men of other nations than are enjoyed by other professions. In the second place, and more importantly, the very nature of the body of knowledge with which we deal knows neither time nor place, nor nations, nor peoples. As a profession, then, we have common ground with men of all kinds and conditions. Whatever we do toward furthering meetings on that common ground, toward fortifying and confirming it as a starting point for other meetings by other men, is so much done toward the inculcation of collaboration and concord among all the peoples of the earth.—*Vannevar Bush.*

Malocclusion and psychological factors

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Some psychological factors in attitudes toward malocclusion are identified and discussed, particularly the effect of the patient's malocclusion on the perception of the patient by other persons, and the patient's reactions toward his malocclusion. Two technics were tested for answering the question: How important are dentognathic conditions as cues to personality impressions when compared to all other cues? Suggestions for further research are presented.

Many observers have noted that demand for correction of malocclusion is often based on psychological factors rather than reasons of health. In spite of the recognition of the role played by psychological factors in attitudes toward malocclusion, little research has been aimed at investigating the underlying personal and social factors. This article is an attempt to identify the main problems involved and to indicate the advantages and disadvantages of various experimental approaches.

Perhaps the most important variable is the "interpersonal adjustment" of the individual, which has two aspects in relation to malocclusion: (1) the effect of the patient's malocclusion on the perception of the patient by other persons; (2) the patient's reactions toward his malocclusion and toward the way others behave toward him. This discussion will be confined primarily to these aspects of the problem.

Although the perception of people is currently an important area of psychology,[1-7] little systematic research has been done in this area in previous years. Studies of appearance, particularly facial appearance, with behavioral factors controlled, have shown that people attribute personal characteristics to others on the basis of facial characteristics. Apparently, persons with certain physical features commonly are thought of as having certain personality characteristics.[3, 5, 6]

A fundamental question is: How important are dentognathic conditions as cues to personality impressions when compared with all other cues? Normally, impressions of other persons are formed on the basis of a multiplicity of facial and body appearances, expressive movement, overt behavior and verbal behavior. The extent to which a particular pattern stands out as a factor determining the observer's impression of another person may be termed saliency. The many cues which might influence an observer vary in saliency from those of extremely minor significance to those of some importance.

One technic suggestive of how this problem could be approached was tried by the authors. This procedure involved the comparison of memory of a person's face with ratings of his face when he

was present. Using five instructors as stimulus persons, we entered each classroom before the arrival of the instructor, and had the class rate him, using a seven-point numerical scale on each of the 34 physiognomic variables shown in Table 1. After these ratings were completed, each instructor was brought before his class, and the class rated him again on the same variables. For each trait, the memory ratings were compared with the ratings made with the instructor present. Presumably, the more accurately the judges were able to rate an instructor on a particular physical attribute from memory, the more salient this characteristic is.

Table 1 is a presentation of the rank order of traits according to how well they were remembered, based on the average discrepancy for each trait for the five instructors. It will be noted that attributes pertaining to malocclusion are scattered through the rankings from high to low. Not shown in the table but worth mentioning is the fact that the present study produced considerable differences in salience rankings for different stimulus persons, the average correlation between the five sets of rankings being only .24.

Table 1 • Memory for physical attributes*

Rank	Attribute
1	Height
2	Deep-set vs. protruding eyes
†3	Protruding vs. receding chin
4	Weight
5	Grooming of hair
6	Height of eyebrows
7	Dark vs. light complexion
8	High vs. deep voice
9	Small vs. large bones
10	Dull vs. bright eyes
11	Wide vs. narrow eyes
12	Square vs. round face
13	Mouth curvature
14	Large vs. small nostrils
15	Width of nose
†16	Whiteness of teeth
17	Facial tension
18.5	Length of hair
18.5	Fullness of lips
†20	Round vs. square chin
21	Size of mouth
22.5	Compressed vs. relaxed lips
22.5	Smoothness of skin
24	Length of nose
25.5	Straight vs. wavy hair
25.5	Curvature of eyebrows
27	Prominence of cheekbones
†28	Protrusion of upper teeth
29	Vertical wrinkles
30	Eyelid visibility
31	Eye-corner wrinkles
32	Bow-shaped vs. straight lips
†33	Straightness of teeth
34	Horizontal wrinkles in brow

*Attributes are ranked according to the sum of the differences between ratings from memory and ratings made with the stimulus persons present.

†Dentognathic characteristics.

Unfortunately, in the case of some attributes, these rankings are not necessarily representative of salience, for the following reason: When a judge rates a trait for which his memory is extremely vague, he is likely to choose the midpoint of the scale, 4. If stimulus persons are average in the trait, the over-all discrepancy between ratings from memory and ratings with the stimulus person present will tend to be small. This kind of small discrepancy is indistinguishable from a small discrepancy produced by good memory for a trait. An example is the case of "protruding-receding chin," which yielded many ratings at the center of the scale. In future studies, this problem can be avoided by having judges rank stimulus persons on attributes, instead of rating them, thus avoiding all forms of response sets. This procedure has one practical disadvantage: a single group of judges must be familiar with k stimulus persons, k being equal to the number of ranks.

The writers also conducted another study measuring saliency, adapting a method developed by Gardner and Thompson.[2] Three dentognathic variables and one unrelated variable were used. These were protrusion of upper teeth, protrusion-recession of chin, straightness-crookedness of teeth, and amount of lipstick.

Fourteen adults were asked to identify persons falling at five points along a continuum on each of the foregoing dimensions. One week later, subjects rated the previously identified persons accord-

Table 2 • Rated attributes of personality impressions*

sincere	conscientious
outspoken	self-confident
intelligent	sense of humor
easily hurt	alert
dominating	warmhearted
conceited	likeable
talkative	aggressive
good-looking	

*In the rating scale form, each attribute had the numbers 1-7 listed after it, so that the appropriate one might be encircled.

ing to their impressions of personality characteristics. Seven-point scales were provided, listing the attributes shown in Table 2.

The foregoing procedure provided two kinds of data. The first was an ordering of actual acquaintances on particular dentognathic variables (subject, of course, to limitations in the perceptiveness and memory of the judges). The second was a quantitative appraisal of the personality impressions which the judges had formed concerning these persons. By examining the personality characteristics attributed to individuals at various points on each dentognathic dimension, we were able to ascertain whether or not impressions of personality were associated with dentognathic variables. It should be kept clearly in mind that the assumption is not made that personality traits attributed to these acquaintances are actual characteristics; rather, these are impressions which others have formed, which may or may not be correct.

Figures 1 through 5 present the data for only those variables which resulted in significant differences. Statistical significance was determined by an analysis of variance procedure, a separate analysis being made for each personality attribute. Each point in the figures represents the summed ratings of all of the stimulus persons placed at that point on the malocclusion dimension by the 14 judges. The fact that the figures are based on summed ratings gives them considerable stability.

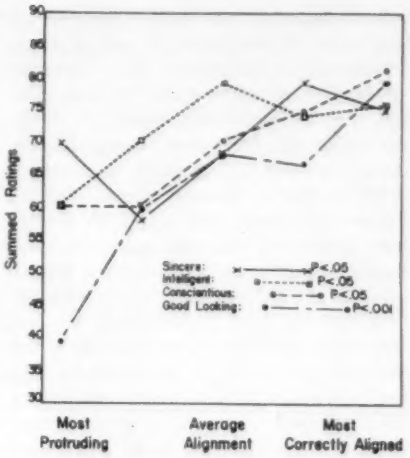

Fig. 1 • Impressions of personality associated with alignment of upper teeth

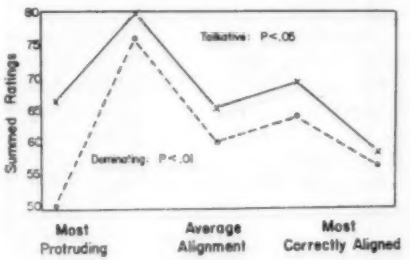

Fig. 2 • Impressions of personality associated with alignment of upper teeth

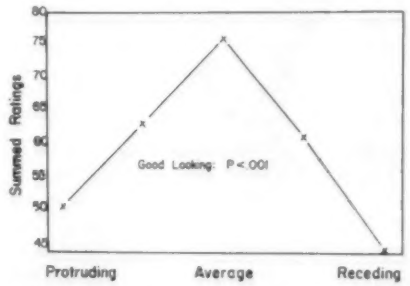

Fig. 3 • Impressions of personality associated with protruding-receding chin

It is clear that the judges associate at least some personality traits with various dentognathic conditions. The variable "protrusion of upper teeth" is most salient, with six personality attributes yielding significant differences among persons varying on scale points from "protruding teeth" to "most correctly aligned teeth." Figure 1 reveals four attributes which have a rough linear relationship to protrusion of upper teeth. With some departures from linearity, sincere, intelligent, conscientious, and good-looking are increasingly attributed to persons with more correctly aligned teeth. As shown in Figure 2, however, talkative and dominating have a rough inverted U-shaped relationship to protruding teeth, with persons having either the most protruding teeth or the most correctly aligned teeth yielding impressions of being lowest on these variables, and persons with moderately protruding teeth being highest.

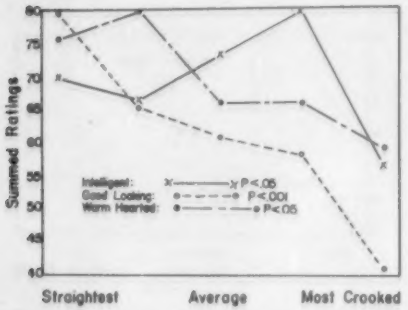

Fig. 4 • Impressions of personality associated with crookedness of teeth

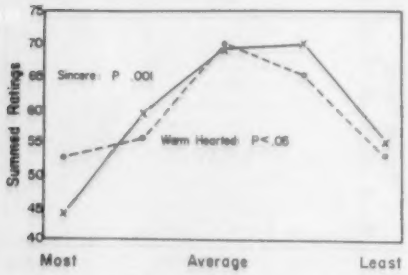

Fig. 5 • Impressions of personality associated with amount of lipstick

Protruding or receding chin appears to produce little in the way of specific personality impressions, being related only to "good-looking" (Fig. 3). Crookedness of teeth appears to be linearly related to warmheartedness and, of course, to esthetic appearance; and, in a rather complex way, to intelligence (Fig. 4). Rather surprisingly, the amount of lipstick does not relate to many specific impressions (Fig. 5). This contrasts with findings from photographic studies where the amount of lipstick worn is a crucial determinant of impressions.

Instead of approaching the problem by way of salience, one may directly compare degree of malocclusion with a measure of personal attractiveness. Several investigators working as a team[8] have used difficulty of treatment as a measure of degree of malocclusion, using ratings of casts of teeth of 39 high school students. Also obtained were photographs including a front and profile view of these students, which were rated for over-all esthetic appearance by professional dental personnel and clerical assistants. These authors kindly made their data available to us for analysis, a summary of which is reported in Table 3. Moderate agreement among the ratings of casts for difficulty of treatment by three orthodontists[9] is represented by an average correlation coefficient of .63. There is also agreement among judges on the esthetic ratings of profile and of front views of the high school students considered individually, these correlations being .73 and .65, respectively.

Of crucial interest, of course, are the correlations between ratings of degree of malocclusion in terms of difficulty of treatment and esthetic appearance. These turn out to be .30 and .21 for profile and front views, respectively, indicating a low relationship. When esthetic ratings

Table 3 • Correlations between malocclusion and esthetic appearance*

Agreement among judges on ratings		
	3 orthodontists	Agreement on esthetic ratings among 7 judges
Casts	.63	
Profile		.73
Front		.65
Front vs. profile		.70

Correlation between cast ratings and esthetic appearance			
	All judges	3 clerical judges	4 dental judges
Profile	.30	.24	.30
Front	.21	.08	.27

*In all instances, average r's are reported (N = 39). They were obtained by conversion from Kendall's W.

and difficulty of treatment are correlated separately for the clerical and the dental personnel, the correlations are .24 and .30 respectively for profile, and .08 and .27 for front view. In the instance of front-view photographs, at least, impressions of esthetic appearance formed by judges trained in professional dentistry are more likely to be influenced by the severity of conditions of malocclusion.

Considering that ratings of difficulty of treatment were made from casts and concerned malocclusion conditions which often are not visible in a photograph of the face, the present relationship between conditions of malocclusion and attractiveness may be regarded as attenuated. Moreover, it should be kept in mind that had persons with more severe malocclusion been included, the correlation between malocclusion and attractiveness would have been appreciably higher.

SUGGESTIONS FOR FURTHER RESEARCH

Data reported in the previous section must be regarded as purely tentative and suggestive only. There are a variety of problems which should be taken into consideration in further designs of experiments on malocclusion.

Sampling • Several different kinds of sampling must be considered, depending on the design which is chosen. First, in sampling the population of stimulus persons, a crucial problem would be that a representative sample of the general population would contain only a small number of persons with serious malocclusion. On the other hand, this kind of sample would yield information concerning the role played by minor degrees of malocclusion in impression formation. An alternative to this procedure would be to use a selected sample of subjects with serious malocclusion conditions, contrasting them with a control group selected at random from a population.

Another sampling problem concerns the question of who shall be the judges of the stimulus persons. If adolescent stimulus persons are used, there would seem to be considerable advantage in using adolescent judges. Certain aspects of the stimulus person might be so important to the adolescent that malocclusion would be a very minor factor. Another factor involving judge sampling is the comparison of personnel trained in dentistry versus the layman. Do the attitudes of trained personnel toward the esthetic appearance of the stimulus person differ considerably from the attitudes

of the lay population or is there the same frame of reference?

A third sampling problem concerns the question of how to represent the stimulus persons. For example, one might use photographs, as has been done in some of the preliminary work. This use, of course, means that all of the behavioral cues are eliminated as determinants of impression formation. It might be that all facial cues are of only minor importance in the impression which a person has of another person; this could not be determined in photographic studies. At the opposite extreme, experiments could involve judgment of persons in face-to-face situations. A further consideration is that malocclusion might have a differential weight where the stimulus person and the judge are acquainted with each other.

Decisions on these various questions of sampling cannot be made entirely independent of other aspects of methodology which are used in any future design. A consideration of some of the other important factors follows.

Salience • One of the most crucial questions concerning the relation of malocclusion to interpersonal adjustment is: How important are dentognathic conditions to personality impressions when compared with all other cues to personality impressions? Designs aimed at answering the question of saliency but which bypass some of the other perplexing problems faced by the investigator have already been discussed.

In another design to test saliency, one group of judges rate photographs on several dozen physical characteristics including some dentognathic characteristics, such as those in Table 1. A second group of judges rate the same photographs on various personality impressions, on attributes such as those listed in Table 2. Appropriate statistical procedures are available for determining the strength of the effect of the various physical cues on the personality impressions gained by viewing photographs.[3] This could lead to a statement of the relative importance of dentognathic characteristics when contrasted with other facial characteristics. If malocclusion is shown to have reasonable importance, it would be necessary to go beyond the presentation of photographs in a new study which would use live persons as stimulus objects in a face-to-face situation.

Another saliency design, which gets at the subject's own opinions concerning his malocclusion, would take the following form: A series of photographs known to yield certain personality impressions, but which vary in dentognathic characteristics, is shown to persons with at least a moderate degree of malocclusion. A control group of judges consisting of those who have no important malocclusion would also be used. The two groups are then asked which of the photographed persons they "would like to be" and which they "would least like to be." The crucial question is: Do those judges with malocclusion choose those with good teeth to a greater extent than do those judges who do not have malocclusion? This is essentially an indirect measure of dissatisfaction with one aspect of the self-image.

Another more direct approach to saliency as far as the self-image is concerned would be to use a questionnaire like the body-cathexis measure developed by Secord and Jourard.[4] This inventory obtains a quantitative measure of positive or negative feelings toward various aspects of the body as nose, hands, profile, chin, height and so forth. If dentognathic characteristics were included one could then determine the importance to individuals of these variables as compared with other aspects of the bodily appearance.

Still another approach to saliency involving utilization of the physiognomic attributes listed in Table 1 would be to present various photographs, one at a

time tachistoscopically (that is, with a relatively brief exposure), asking subjects to rate the photographs on the various characteristics. Exposure times would begin below the threshold of recognition and gradually increase to the point of easy recognition. The attributes yielding agreement among judges with the briefest exposure times would be those which are most salient.

Before-After Design • Perhaps a feasible approach to the study of the effects of malocclusion on impressions of personality would be to obtain photographs of persons before and after treatment. The group of judges rating the photographs before treatment could be compared with a matched group of judges rating the photographs after treatment.

Unfortunately, there are several uncontrolled factors in this procedure. Orthodontic treatment takes a considerable period of time and the fact that the person is older when the posttreatment photograph is taken may make a considerable difference in impressions. Furthermore, it probably would be necessary to take and collect the photographs with this particular experimental design in mind, in order to equate for as many factors as possible. From a review of photographs in existing files, it is clear that very different personality impressions are yielded by pretreatment and posttreatment photographs because of factors unrelated to treatment; in some instances, subjects are smiling, and in others, not. Another problem stems from the widespread use of an instrument for holding the head in a particular position. This instrument, even if its use is explained to the judge, appears to have a considerable effect on the personality impression formed. It is conceivable that the effects of age could be determined by appropriate statistical procedures by having a control group not receiving treatment whose photographs would be taken at intervals of two years or so.

SUMMARY AND CONCLUSIONS

The assumption is made that "interpersonal adjustment" is an important psychological variable in relation to malocclusion conditions. Two facets of interpersonal adjustment are: (1) the effect of conditions of malocclusion on the perception of the patient by other persons, and (2) the patient's reactions toward his malocclusion and toward the way others behave toward him. The concept of saliency was introduced and defined as the extent to which a particular perceptual cue stands out as a factor determining the observer's impression of another person. Several preliminary studies were conducted to determine the relative saliency of dentognathic characteristics as facial cues. These identified certain dentognathic characteristics as important in impression formation, but interpretation is limited by the methods employed.

In another study, difficulty of treatment of malocclusion conditions was compared with ratings of esthetic appearance. Positive but relatively low correlations were obtained.

In a final section, problems of method in future research on the topic were discussed. These were problems involved in defining and sampling the population of stimulus persons, the judges, and representations of the stimulus persons (photographs, face-to-face contact, and so forth); varieties of ways of measuring salience, and several possible approaches to studying self-reactions to malocclusion in the patient.

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Denture outline form

William G. Maison, D.D.S., San Francisco

The impression of the tissues and all of the denture base region should not be complicated by unnatural movements of the musculature. The patient should not be allowed to muscle trim the impression. The dentist should know where to place the peripheral juncture. The flanges must contact the relaxed mucous membrane at the reflection of the mucobuccal fold. The survey of the peripheries of the denture's residual basal seat is a separate operation which cannot be accomplished at the same time that the impression is made.

Better denture service begins with the impression. The making of the impression may be accomplished with innumerable materials available to the practitioner; choice of materials is a matter of individual preference.

The surveying of the peripheries of the denture's residual basal seat is a separate operation. It cannot be accomplished at the same time as the making of the impression. The taking of an impression of the tissues of the mouth and the musculature should be one objective—the tissues of the mouth being in the most static condition possible with the absolute minimum of pressure. An impression of the functioning musculature cannot be made. The important thing is to take the precise impression of all the tissues in the mouth. Tilton[1] wrote,

> I wish to emphasize several points I believe to be facts: that the making of the impression base and the addition of the periphery are separate and distinct operations; that they should not blend one into the other; that they should not be finished at the same time. . . .

Peripheral sealing is that positive contact of the entire perimeter of the denture base to the yielding tissues outlining the basal seat which includes the post-dam area at its flexible line of the soft palate muscles, as well as its buccal and labial periphery (lingual of the lower denture). This seal, preventing ingress of air, is effective only when the entire circumference and the contacting tissues are moist with saliva. Because of the effectiveness of this valve seal, any dislodging force is resisted by the "suction" provided by the atmospheric pressure.

In relation to current practices of effecting peripheral sealing, a statement by Young[2] is most apropos:

> It is apparent to any dentist who gives a little thought to the profession's denture service that the correctness of present day theories and technics taught in dental colleges and in general use by the profession are and should be questioned.

Experience becomes the best teacher through trial and only with the appreciation of the causes of errors.

FUNCTIONAL MOLDED PERIPHERIES

Functional molded peripheral borders are formed while the impression is being taken. The patient moves the borders of the tissues by prescribed functional movements of the cheeks, lips and tongue. The operator instructs the patient in the movement of the cheeks, as in sucking, grinning, and so forth, or "by draping the lip upward or slightly inward." In the instance of the lower denture, the tongue is placed out on the extension of the tray or on the corners of the lips and the patient is instructed to make various and unorthodox movements of the mandible, cheeks, lips and musculature. These are indeed not the regular movements or functions of these anatomic structures. Of course, these tissues are now functioning against strange and unknown objects. The tension, tautness, and the peripheral tracings on this unknown impression material are entirely foreign. The performance of all these gymnastics will hinder the placement and aid in the displacement of the tray and impression materials, and make it more difficult to obtain a nonpressure impression. The resultant denture base will not be in contact with relaxed and undisturbed soft tissue but with misplaced and displaced tissue.

The impression of the tissues and all of the denture base region should not be complicated by unnatural movements of the musculature. Gyrations and gestures of the oral musculature cannot possibly be registered at this time of impression-taking on any impression material.

> The use of the misnomer "muscle-trim" in our prosthetic literature and teaching should be either revised or stricken from the books. It is impossible to trim a slowly cooling modeling compound or wax border, or setting wash, by molding border tissues without distortion or displacement of these tissues. Peripheral tissues must be able to cut through the impression material, and mold themselves into it without movement or external massage.[3]

MANUAL MOLDED BORDERS

Manual molded borders are accomplished by the operator by moving the lips, cheeks, or the musculature with his fingers. The open or closed mouth impression technic may be used with this system. The closed mouth technic is accomplished by placing biterims, or the use of a central bearing point on the impression trays. The assumption is that the physiological loading of the tissues by the patient's biting pressure is obtained.

These methods were advocated by J. W. Greene in *Greene Brothers' Clinical Course in Dental Prosthesis,* published in 1910. All dentists are familiar with these procedures. The wide range of working qualities of impression materials and the various tensions of tissues of the musculature indeed leave much open to question in regard to the amount of tension and pressure placed on the peripheries of these impressions, together with an individual's requirements of tolerance. If the material is too thick, causing undue tension, the tissues will be overdistended. Such a method cannot be the answer to proper peripheral contact. It is not feasible to expect that the functioning oral musculature would react on sluggish compounds or any other inert materials which bridge and distort (such as extra-soft waxes, indicator gels, or other semi-confined plastics). These materials have a wide range of working qualities and various

resistances to tissue tension. Hence, muscle trimming or the impression of the vibrations of movement of the flexible periphery is not possible. There was no other way to acquaint dental students with the musculature of the oral cavity than to impress on them the outline form in the mucobuccal fold of the upper and the lower (lingual) dentures. Thus, muscle trimming with a compound was used to familiarize dental students with all of the outline of the denture bases. This method, no doubt, is the only method to approach in the education of the student. However,

> . . . the muscles involved in mastication, deglutition, speech, etc. perform their movements involuntarily during their normal functional activity; the more nearly we can simulate these conditions during the process of developing the impression and completing the dentures, the more perfect they will be. The muscles involved in denture construction will contract and be distorted the instant the operator tries to manipulate them arbitrarily. We should remember that we cannot follow our patients around and manipulate these tissues for them as they pursue their daily activities . . . . for the way we think or wish these tissues would perform and the way they function normally are entirely different.[4]

CONSISTENT OUTLINE FORM

There are advocates of consistent extension outline form for dentures. They consider anatomy to be consistent with their concepts of the similarity of the denture outline form which is drawn graphically on the casts according to the particular anatomical landmarks that are established in anatomy textbooks.

Refuting this concept is the known fact that the mandible is an ever-changing body from conception and birth, through growth, loss of teeth, deterioration of the alveolar process or the alveolar bone itself, and into edentulous old age. Some of the changes are pertinent also to the maxilla, not to mention the many changes of the musculature, as loss of muscle tone, altered muscle attachments, and so forth.

The histological, physiological and actual anatomy and the *modus operandi* of the individual patient, the variation of his action of the muscles of expression and articulation must be observed empirically. The dentist must examine the patient's mouth visually and digitally, and not rely on a predetermined, arbitrary outline form devised from incorrectly illustrated, nonfunctional anatomical charts.

NONPRESSURE TYPE IMPRESSION

Mere capping of the residual ridges and a minimum flange extension, entirely disregarding any effects of atmospheric pressures, cannot be compared with the results obtained by observing the generally accepted concepts of retention. Men of prosthetic knowledge commonly say, "Maximum coverage and flange extension. . . . Equitably distribute the occlusal load over the greatest possible area. . . . Extend a well-defined periphery to within the limits of tissue tolerance, to gain lateral denture stability and valve seal. . . . The flanges possess important stabilizing influences." The work of such men as Skinner, Campbell and Chung[5] bears quoting: ". . . Chung found . . . that the retention of a complete baseplate was increased by the post-dam and the peripheral seal."

GENERAL COMMENTS

Observation of the peripheral border and its functions often is left entirely to the guesswork of the dental mechanic who merely sees the abstract on the stone cast. He proceeds by drawing certain arbitrary lines for the denture borders on the casts from one specified landmark to another, making no allowance for individual variations. "These and other arbitrary impression technics are an insult to the intelligence, education and training of dentists."[6]

Dentures do not meet biological demands if the mucosa to which they adhere shows signs of inflammation. For this reason the use of peripheral seal, including the customary post-damming, is to be avoided whenever possible.[2]

This may be true in instances where the super-pressure or stress-type impression inflicts atrophy due to frictional retention and the outmoded practice of excessive "beading" at denture peripheries to obtain that "tight fit."

These denture bases have a tight outline seal until such time as the tissues and the underlying bone give way to the beading's excessive pressures. Then the denture loses its adherence because of leakage at the periphery. This overtaxes the biological demands on denture tolerance. However, some tolerance of the denture base must be anticipated. Dentures can be only tissue-supported (mucosa adherent) objects. As Skinner and others[5] state:

> It is evident that the most effective addition, as far as an increase in retention is concerned, was the post-dam. The retention was increased by this addition in the areas mentioned in every case. As can be noted . . . any reduction in the post-dam produced a decrease in retention.

MOUTH EXAMINATION

The importance of the examination of the mouth cannot be overstressed. To dwell upon this subject would be wearisome. No doubt, it is the most important step for diagnosis and prognosis. Time spent in investigation of favorable and unfavorable factors will be well rewarded with every step preceding the completion of the denture. Some surgical procedure may be necessary in the instance of abnormal anatomical difficulties, but it is assumed for the purposes of this article that the jaws dealt with are in suitable condition for the reception of dentures.

RECORDING OF TISSUES

The aim of the impression technic should be to obtain an impression of the denture-bearing adaptation regions in a position of normalcy, and to obtain an overextended impression of the tissues of the jaws covering the greatest possible area of available tissue surface. The tissues should be recorded in their absolute passive state or undistorted, unstrained position, with the patient at complete rest. Provision should be made for the full escape of any introduced force while the impression is being taken, allowing the least amount of applied force to be exerted; only one insertion of the tray should be required. These impressions are extended purposely beyond the limitations of the anatomical and physiological tolerance that will be incorporated within the peripheral borders of the finished dentures, and posteriorly slightly beyond the fovea palatina.

The impression material may be one of choice, such as plaster of paris or one of the prepared plasters which are manufactured under various trade names, or any other material which will meet the necessary requirements. At present, the alginate impression materials are the materials of choice. As can be prejudged, the cast will cover a considerably greater area than is necessary for the denture's coverage. Later, the functional outline or correct physiological border extension, marginal adaptation and contours, and the denture-bearing regions will be surveyed by direct visual and digital observation.

COMPARATIVE DENTURE ANATOMY

Dealing with living functional tissues requires a complete knowledge of functional anatomy and anatomical landmarks, not anatomy based on theory and observation of dry bone alone. With the patient and an overextended cast of the jaw at hand, the dentist proceeds to trace on the cast with pencil the border outline of the denture. The armamentarium consists of a mouth mirror, a "rubber-tipped explorer,"[8] a good mouth light and what

Blanchard calls "eyes in your fingers."[9]

The dentist proceeds from the post-damming area of the areolar tissue which can receive the extra pressure of the post-damming between the maxillary tuberosity and the pterygoid hamulus notch which has been post-dammed. The coverage of the maxillary tuberosity is without question necessary as an aid to resist traction or lateral strain. It offers that resistance to the denture which prevents it from skidding on its basal seat, preventing an anterior truss to the base.

There must be the necessary intermaxillary clearance not to interfere with the action of the ramus or the clearance for the lower denture base over the retromolar region. The functional activity of the pterygomandibular raphe is observed to ascertain its tenacity and whether or not it will dislodge the denture during movement of the jaw. Excessive extension of the denture base allowing it to impinge on the superior attachments of this pterygomandibular raphe must be avoided. Instances have been observed where surgical intervention is necessary because of the extra tautness of this attachment, which is a hindrance to the complete capping of the tuberosity.

The denture border should be drawn on the cast to cover the entire buccal space; the marginal outline should be visualized as the well-rounded surface of variable thickness and not as a line. The enveloping of the cheek muscles' suctorial pad around the denture flange in this region will facilitate the seal and be an aid to the retention of the denture; if this flange is too thick, the buccal muscles will dislodge the base when the mouth is opened. The formation of the border and the thickness of the peripheral circumference depends on careful observation.

The maxillary periphery tissue should be familiar to the dentist from his frequent insertions of the hypodermic needle. At sight, he should be able to sketch on the cast the exact functional limits of the mucobuccal fold and not rely on a hypothetical 2 mm. (or less) covering of the movable tissue. Such conjectures lead only to excessive postdelivery adjustments (whittling) which become discouraging both to the patient and to the operator. The degree of mouth tissue tolerance varies greatly and the placing of peripheral borders rests entirely in the prosthodontist's judgment and hands.

PLANNED PLACEMENT OF THE TISSUES

One or more, possibly three or more, buccal frenums are now observed. They may be extremely stringlike and strong in their tension and may require surgical intervention. However, that is the exception rather than the rule. Most often, they are tensionless and will stretch and thus not displace the denture base.

> . . . certain stresses and strains will not be tolerated under some conditions—under other circumstances, they will be borne with no hindrance and the patient will register no complaint.[9]

The physiological limits of tolerance regarding these frenums is easily determined by tactile and visual examination. Clearing these buccal frenums with deep notchlike reliefs in the peripheral border of the denture is absolutely wrong.

> . . . the notchlike reliefs for the frena in the buccal flanges of the denture base plate produce a sufficient discontinuity in the meniscus of the liquid film to reduce the retention.[10]

The limitations of the labial flange can be seen readily by gentle manipulation of the lips in these regions and the labial mucofold can be traced on the cast to approximate the relaxed mucous membrane under the lips at the reflection of the fold. Properly formed denture borders restore facial contour and support the upper lip, enhancing the appearance.

CONCLUSIONS

Patients cannot be allowed to muscle trim their impression. The dentist should know

where to place the peripheral juncture. The flanges must just contact movable tissue in order to make a satisfactory seal in the region. That is, they must contact the relaxed mucous membrane at the reflection of the mucobuccal fold.

Consideration of the lower border of the zygomatic arch is next. This presents considerable variation in its relation with the crest of the ridge and the denture periphery which must clear this bony arch. If the lower border of the zygomatic arch is allowed to impinge or ride on the ridge, soreness will result and prevent the proper seating of the denture. A problem presents itself when this zygomatic arch is almost the same height as the ridge. It may be possible to bridge the denture periphery over the zygomatic arch and effect a peripheral seal adaptable to the muscle markings of the cheeks.

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A mathematical solution of a problem in full crown construction

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Elementary concepts of geometry and mechanics are employed to illustrate the possibility of treating certain problems in dentistry mathematically. The specific problem considered is: What kind of preparation of a tooth for full crown reconstruction has the best retention form?

The purpose of this article is to illustrate the possibility of a mathematical treatment of certain problems arising in dentistry. The problem selected is a simple one, and only elementary concepts of geometry and mechanics are employed. The aim is to demonstrate that these concepts may be applied to a dental problem in the manner of mathematical analysis. The results obtained are not very startling, but the method used in deriving these results should provide increased confidence in their validity.

Roughly speaking, the problem considered is the following: What kind of preparation of a tooth for full crown reconstruction has the best retention form? As in any attempt to apply math-

ematical reasoning to a problem that is essentially nonmathematical, a necessary first step is a reformulation and simplification. This necessitates making certain assumptions which are plausible, but not proved. These will be as follows:

1. The problem, which is actually three-dimensional, may be treated as a two-dimensional one; that is, a typical plane section of the tooth and the crown is considered, and it is assumed that all forces and motions are confined to this plane (the plane of Figure 1).

2. The crown and tooth are considered to be "rigid bodies." (A body is "rigid" if, for every pair of points in the body, the distance between them remains fixed.)

3. The adjoining surfaces of the crown and the prepared tooth are "frictionless." (Thus, as is customary, a form is sought which is retentive independently of the cement and the forces of friction.)

The class of preparation forms to be considered is defined as follows:

The term "admissible" will be used for a form that consists of three straight line segments $\overline{AB}$, $\overline{BC}$, $\overline{CD}$ as in Figure 1, where the sum of the angles α and β is not less than 180 degrees; that is, it is required that the preparation will not be undercut. The term "form" will be used interchangeably for the exterior shape of the prepared tooth and the interior shape of the finished crown which are assumed to be geometrically identical.

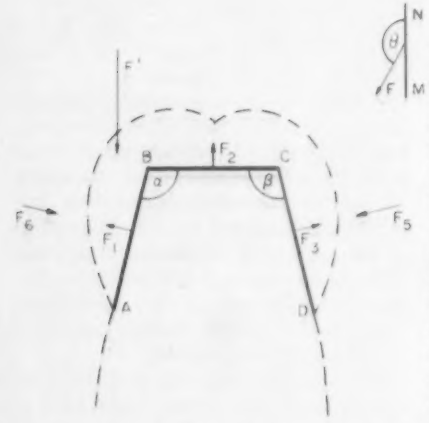

Fig. 1 • The line segment MN is any convenient direction from which the angle θ which determines the direction of F is measured

A force will be represented by an arrow (or vector) which points in the direction of the force and whose length is proportional to the magnitude of the force.[1] A force is completely determined by specifying three things: the direction, the magnitude, and the point of application. It is well known[1] that it is possible to influence considerably the forces that will be applied to a crown during mastication. This can be done by appropriate choice of inclination of cuspal planes and so forth. Although this is an interesting question, this is not the problem under consideration. Instead, all possible directions of the applied force F (see Figure 1) are considered and what happens to the crown with respect to this whole class of forces will be determined. It will be seen that the magnitude and the point of application of F do not play a role.

The direction of F can be given by specifying the angle θ, which may have any value between 0 and 360 degrees.

The terms "retention" or "retention form" have never been defined precisely. Still less precise is the meaning of the expression "best retention form" which has been used in the rough statement of the problem. In order to avoid the obvious pitfalls of using terms which are not precisely defined, a new quantity is defined: the "retentivity" of an admissible form is the range of directions of the applied force F (that is, the range of values of the angle θ) for which the crown does not move in relation to the tooth. Thus, for example, if for a given preparation form the crown does not move under the influence of forces having a certain range of directions, say

between 75 and 100 degrees, but does move for forces having directions outside this range, that form shall be said to have a retentivity of 25 degrees.

With these definitions the problem now can be reformulated as follows: For admissible forms, how can the angles α and β and the lengths $\overline{AB}$ and $\overline{CD}$ be selected so that the retentivity will be maximum? It is convenient to divide the analysis into two parts, geometrical and mechanical.

GEOMETRICAL ANALYSIS

The types of possible motions of the crown relative to the tooth may be classified into two groups:

(a) One point of the crown remains fixed.

(b) No point remains fixed.

(Since it is assumed that the bodies are rigid and two-dimensional, if two or more points remain fixed, there is no motion.)

Motions of type (a) are called "rotations." For a motion of this type the only possible fixed point is either A or D (see Figure 1). Rotation about any other point would require that the crown "penetrate" the tooth. A condition will be derived which, if satisfied by an admissible form, makes certain that rotation cannot occur. If the possibility of rotation is considered, say about A, it is seen that all points of the crown must move on the arcs of circles with A as the center (see Figure 2). If a perpendicular is dropped from A to the segment $\overline{CD}$ as in Figure 2, or its imaginary extension as in Figure 3, the circular arc on which the point E moves is tangent to the line $\overline{CD}$. It is clear that rotation cannot occur in Figure 2 since all the points on the segment between E and C would move on arcs that "penetrate" the tooth. Thus,

Condition 1: A perpendicular from A to the line $\overline{CD}$ must intersect that line at a point E lying between C and D. (A similar condition may be formulated for the other point of rotation, D.)

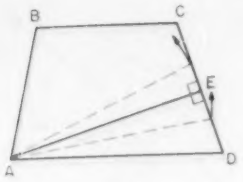

Fig. 2

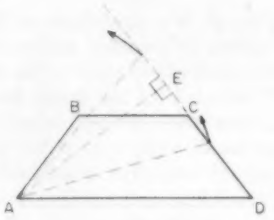

Fig. 3

If Condition 1 is satisfied, only motions of type (b) are possible. If it is not satisfied, rotation can occur (see Figure 3). For forms which fail to satisfy Condition 1 it is apparent that motions can occur even under forces which are directed "straight downward." Thus, for example, a tipping motion would be expected to result from the force F′ in Figure 1. It is assumed that Condition 1 is a minimum condition for any acceptable form. In effect, this geometrical analysis has resulted in a second reformulation of the problem: For admissible forms which satisfy Condition 1, how can the angles α and β and the lengths $\overline{AB}$ and $\overline{CD}$ be selected so that the retentivity shall be maximum?

MECHANICAL ANALYSIS

Condition 1 makes the mechanical analysis of the problem particularly simple. In effect, the point of application of a force can be ignored and only its magnitude and direction need be considered. (This assertion is justified as follows: It is well known that the effect of a force acting

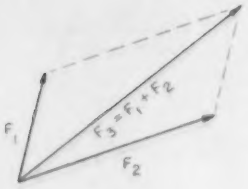

Fig. 4

at a point P of a rigid body is identical to the effect of the same force acting at any other point Q lying on a line through P with direction of the force. However, moving the point of application off this line results in a change of the torques, tending to produce a rotation. In this case, Condition 1 guarantees that rotation cannot occur, hence all torques can be ignored. More precisely, it may be said that the tooth can exert any required torque on the crown.) In order to analyze the effect of the forces, the definition of the vector sum or resultant of two forces F_1 and F_2 must be recalled. This is represented by the construction of Figure 4. The parallelogram, for which two sides are F_1 and F_2, is completed. Then an arrow placed along the diagonal of the parallelogram has the direction and the magnitude of the resultant F_3. This procedure is symbolized by writing $F_1 + F_2 = F_3$. The rules of mechanics which will be used to solve the problem are as follows:

Rule 1. The effect of two forces F_1 and F_2 acting at the same point is identical to the effect of the resultant force F_3 acting at that point.

Rule 2. The effect of a force acting at any point of the crown is identical to the effect of the same force acting at any other point of the crown, provided Condition 1 is satisfied.

Rule 3. A frictionless surface may exert a force only in a direction perpendicular to the surface.

Rule 4. A body at rest (that is, the crown) will remain at rest (that is, in equilibrium) if the vector sum of the forces acting on it is zero.

Rule 5. A "constraining surface" (that is, the tooth) will exert on the body whatever force is required to maintain equilibrium provided it is compatible with rule 3.

The directions of forces which the tooth may exert (rule 3) are represented in Figure 1 by F_1, F_2 and F_3. For the vector sum of any combination of these forces with any magnitudes (that is, any lengths), it can be shown that the resultant force will have a direction lying between the directions of F_1 and F_3. The vector $(F_1 + F_2)$ must have a direction lying between those of F_1 and F_2. Now F_3 is added. The vector $(F_1 + F_2 + F_3)$ must have a direction lying between $(F_1 + F_2)$ and F_3, hence between F_1 and F_3 (see Figure 5). Hence the effect of the forces exerted by the tooth on the crown can be represented (rule 1) by some force F_r whose direction lies between that of F_1 and F_3. For any applied force F, having direction lying between that of F_5 and F_6, the tooth will exert (rule 5) a reaction force F_r which neutralizes F (that is, $F + F_r = 0$) and (rule 4) the crown will remain at rest. The maximum range of directions between F_5 and F_6 is the same as the maximum range of directions between F_1 and F_3 and is, by the definition of an admissible form, 180 degrees, this range being attained only when $\alpha + \beta = 180°$. Thus the maximum retentivity is 180 degrees. (If $\alpha + \beta$ is greater than 180 degrees, for example, $\alpha + \beta = 180° + x°$, the retentivity is $180° - x°$.) If for example, α and β are each 180 degrees (this could not happen

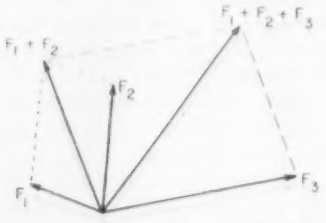

Fig. 5

with a tooth with a vital pulp), the retentivity is zero, and there is only one direction of applied force for which motion does not take place. The solution to the problem is as follows:

The lengths $\overline{AB}$ and $\overline{CD}$ play a role only inasmuch as they must be such that Condition 1 is satisfied. For admissible forms which satisfy Condition 1, the maximum retentivity occurs when the angles α and β are such that $\alpha + \beta = 180°$.

DISCUSSION

As previously stated, the purpose of this paper is to illustrate how a mathematical analysis can be utilized in the field of dentistry. The result of this or any analysis is only as valid as its original assumptions. Certain prerequisites have been stated and any violation of them negates any conclusions that have been derived. These prerequisites and their implications are as follows:

1. The crown and the tooth are considered to be rigid bodies.

The implication here is that if the gold alloy used in the restoration is too soft or the crown is too thin, bending or distortion of the crown might result; the crown would be nonrigid and the conclusions would be invalid. It can be seen that with forces that would tend to produce rotations the greatest stress would be placed at the points A and D. To assure rigidity of the crown, the gold alloy must be of sufficient thickness at these points.

The term "tooth" in the preceding statement implies the form over which the crown fits. If the tooth structure itself is covered with a thick layer of cement with the crown contacting the actual tooth structure only at the gingival border, the possibility of the cement wall fracturing would result in a nonrigid tooth form. The assumption then is that the crown fits as closely as possible to the actual tooth structure.

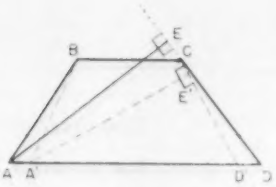

Fig. 6

2. The exterior shape of the prepared tooth and the interior shape of the finished crown are assumed to be geometrically identical.

The formulation of Condition 1 is directly dependent on this statement, for if the crown and the tooth form were not closely adapted (that is, if the inner surface of the crown were relieved) and the cement wall fractured, not only would there be a nonrigid tooth form but the points on the segment of the crown between E and C would not necessarily move on arcs which would "penetrate" the tooth.

3. A perpendicular from A to the line $\overline{CD}$ (as in Figure 2) must intersect that line at a point E lying between C and D (Condition 1).

As seen in Figure 3, a situation exists that does not satisfy Condition 1. The preparation can be corrected so that Condition 1 is complied with by (1) increasing the lengths of $\overline{AB}$ and $\overline{CD}$ and (2) altering the angles so that $\alpha + \beta$ more closely approaches 180 degrees, making the walls $\overline{AB}$ and $\overline{CD}$ more nearly parallel. Increasing the lengths of $\overline{AB}$ and $\overline{CD}$ would necessitate carrying the preparation further under the gingiva and in most instances would be impractical. The preparation can be corrected, however, by producing a shoulder at A and D as in Figure 6, allowing a proper selection of the angles α and β.

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The use of silicone material for impressions of deep-seated cavities

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The setting time, elasticity and dimensional stability of silicone rubber base materials are described. An impression technic for deep-seated proximal cavities is presented which takes advantage of the properties of the silicone material and avoids the preoperative treatment of the gingival tissues with astringents or vasoconstrictors.

The introduction of elastic impression materials made from a silicone rubber base as a substitute for mercaptan rubber base has created widespread interest. This paper attempts to demonstrate the use of silicone impression material in deep-seated proximal cavities by relating the physical properties of this material to its clinical application.

It is generally accepted that in patients past the age of 25, the gingival margins of the restorations should be placed beneath the crest of the gingival tissue, at a plane midway between the crest of the gingiva and the deepest portion of the gingival crevice.[1]

With the introduction of agar, mercaptan and silicone base materials for impressions, it became necessary to retract the tissue around the gingival floor; otherwise, the easy-flowing material was apt to take an impression of the gingiva rather than the floor of the cavity.

Fibers soaked in an 8 per cent solution of epinephrine or zinc chloride have been used to shrink the tissue sufficiently to expose the gingival floor. This method becomes more difficult when the proximal portion of the cavity is deep, since it requires an increasing amount of shrinkage of the tissue in order to expose the gingival floor. Moreover, the use of high concentrations of epinephrine on lacerated gingival tissue carries with it the possible hazard of absorption of enough epinephrine to produce a systemic effect. Similarly, strong solutions of zinc chloride produce an escharotic effect. The use of epinephrine or zinc chloride to reduce the height of the gingival tissue is not recommended.[2]

It was proposed to use a copper band around the prepared tooth to separate the gingival portion of the cavity from the tissue, obviating the need to shrink the gingivae. Studies, therefore, were undertaken to determine, from a clinical viewpoint, the behavior of silicone material when used for impressions in connection with a copper band.

PROPERTIES OF SILICONE IMPRESSION MATERIAL

Setting Time • It is difficult to establish a definite setting time for the silicone rubber base materials since they continue to polymerize for a long time. However,

it is possible to determine when sufficient polymerization has taken place to allow safe withdrawal of the impression material from the mouth. A blunt instrument was used to probe the material. When the instrument left no visible indentation, it was assumed that the material had set sufficiently to permit safe withdrawal from the mouth. These experiments were carried out with three different silicone mixtures. Each mixture contained four inches of silicone paste as extracted from the commercial tubes; this is equivalent to 5 Gm. of silicone material. To the paste were added 1 drop, 2 drops and 3 drops of catalyst respectively. The silicone material and the catalyst were mixed until all colored streaks, which originated from the catalyst, disappeared. The setting time of the three mixtures then was tested with a blunt instrument. As Figure 1 shows, if 2 drops of catalyst are used, at least nine minutes should be allowed from the time of mixing before the impression is withdrawn. It requires approximately three minutes to mix the material, and the impression, therefore, should remain in the mouth for at least six minutes.

Figure 1 also shows that the amount of catalyst used in the mixture affects the setting time of the material. When 3 drops of catalyst, instead of the ordinary 2 drops, are added to the standard amount of paste, the setting time is reduced and the material can be removed two or three minutes earlier. On the other hand, if only 1 drop of catalyst is mixed with the paste, the impression cannot reliably be removed intact until at least eight minutes have elapsed after insertion.

Additional tests were made to determine the effect of the contact of a fast-setting silicone mixture with a slow-setting material. One drop of catalyst was added to the paste and the mixture was ejected from a syringe into a test cavity surrounded by a copper band. A tray was placed over it which contained material in the proportion of 4 drops of catalyst to 6 inches of paste. Testing with a

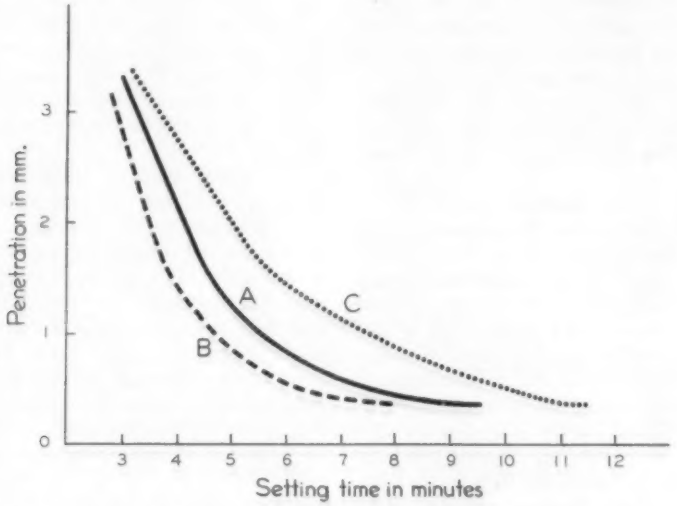

Fig. 1 • Setting time of silicone impression material in regard to amount of catalyst used. A, mixture containing 2 drops of catalyst. B, mixture containing 3 drops of catalyst. C, mixture containing 1 drop of catalyst

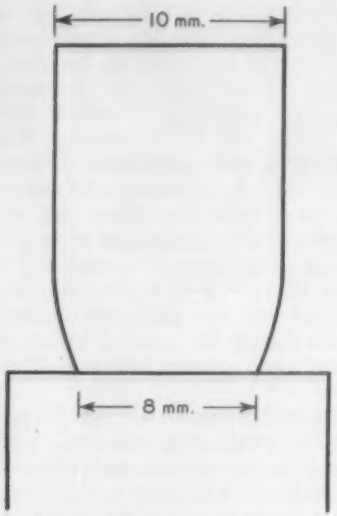

Fig. 2 • Die used in testing elasticity of silicone impression material. Side walls of die meet at an angle of 90°. Distance between two opposing side walls of die is 10 mm. At its lowest region distance between two opposing walls is only 8 mm.

blunt instrument showed that the material applied with the syringe allowed no perceptible penetration after six minutes' setting time in the mouth. Apparently, diffusion takes place between the fast-setting and the slow-setting material, thus accelerating the setting time of the latter.

Elasticity • An essential quality of silicone materials is that they should resume the original shape with as little permanent deformation as possible after being stretched or compressed. There is a close relation between the setting time of the material and its elasticity. The elasticity increases greatly in the period between a five minute and a ten minute set.[3] When the amount of catalyst added to the mixture is increased, the setting time decreases and elasticity develops much more rapidly.

Tests were carried out to study the elastic characteristics when the impression material is used with a copper band or a tray. For this purpose a die was made on which the four side-walls meet each other at an angle of 90 degrees. At the lowest region of the die the walls converge forming an undercut. In the upper regions of the die the distance between two opposing side-walls is ten mm.; in the lowest region only 8 mm. (Fig. 2).

The first series of impressions was taken in copper bands which allowed a thickness of approximately 2 mm. for the impression material between the die and the band. All impressions were mixed in the proportion of 2 drops of catalyst to 4 inches of silicone paste. They were allowed to set for six minutes on the die before removal. Stone models were poured immediately. The distance between two opposing walls in the undercut area was measured with a micrometer. An increase in the measurement indicated deformation of the material.

In the second series the proportion in the silicone mixture was changed to 1 drop of catalyst. At the six minute period the setting of the material on the die was not complete and consequently its ability to regain its original shape was lessened. If eight minutes were permitted to elapse before the impression was removed from the die, the elasticity was about the same as that of a standard mixture after six minutes.

The third series of impressions was taken by combining two impression materials. The first one, in a syringe, was used on the die and around the copper band. It contained 1 drop of catalyst. The second impression, for the tray, was mixed by adding 4 drops of the catalyst to six inches of silicone paste. Figure 3 indicates that the elasticity increased after three minutes, and after seven minutes was approximately the same as the elasticity of the standard mixture after six minutes.

Dimensional Stability • The setting of silicone material is by condensation

polymerization. Some volatile material is formed;[4] consequently, there is shrinkage.[5] During the first 30 minutes after the mixing of the material no appreciable change occurs.[5] If the material is held in place with a copper band, either by means of perforations or with an adhesive material, contraction is reduced to a considerable extent.[5] Recent investigations at the department of dental materials of Marquette University indicate that most of the dimensional change occurs after 60 minutes from the time of mixing.

Since the silicones do not possess complete dimensional stability, it is best to construct the cast within 30 minutes after the impression has been withdrawn from the mouth.

IMPRESSION TECHNIC FOR PROXIMAL CAVITIES

With the knowledge of the behavior of silicone material when used with a copper band, the following impression technic for deep proximal cavities has been developed.

Selection of Copper Band • The band should be large enough so that it will fit loosely around the prepared tooth. Its gingival portion should extend below the gingival floor of the preparation and its occlusal edge should be trimmed below the occlusal surface. The band should be annealed and should be painted with a silicone adhesive material. If possible, four or five holes should be drilled into the band.

Preparation of the Metal Tray • The tray is constructed from a perforated metal sheet as illustrated in Figure 4, above left. It should be cut lengthwise so that it extends only over the two teeth adjacent to the one in which the cavity has been prepared.

The buccal and lingual ends are bent to form a 90 degree angle with the oc-

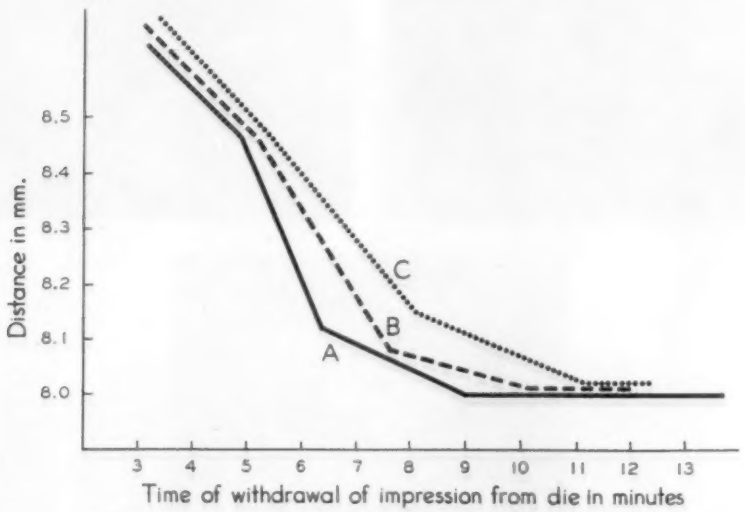

Fig. 3 • Elasticity of silicone material according to proportion of catalyst in mixture. A, silicone mixture containing 2 drops of catalyst. B, silicone mixture containing 1 drop of catalyst. C, combination of two mixtures: first contained 1 drop of catalyst; the second was mixed in the proportion of 4 drops of catalyst to 6 inches (7.5 Gm.) of silicone paste

clusal portion. They should be cut short enough so that they will not impinge on the gingival tissue. The margins of the tray should be free of rough edges.

A handle is attached to the tray on the mesial end (Fig. 4, above right). The screw which extends from the handle into the inner side of the tray serves as a stopping device for the impression. It prevents the operator from pushing the tray onto the occlusal surfaces of the teeth. In this manner it guarantees a sufficient amount of impression material between the teeth and the tray.

When the tray is in position, there should be space for a uniform thickness of the silicone material on both the buccal and lingual sides of the teeth.

Mixing of the Silicone Material • Two pads are prepared and one is marked "syringe type," the other "tray type." Four inches of the silicone paste are ejected on the syringe pad and 6 inches of the paste on the tray pad. For the syringe mixture 1 drop of catalyst is added; the tray pad receives 4 drops of catalyst.

The syringe mixture is thoroughly spatulated and inserted into the syringe. This material is injected into the cavity and around the inside of the copper band. The cavity must be dry since silicones are water-repellent. The injection should begin on the lingual side of the copper band, slowly filling up the proximal portion of the cavity. As the syringe-needle approaches the occlusal portion, the material should flow ahead of the needle in order to avoid air bubbles. While the injection is being performed, an assistant mixes the tray material and loads the

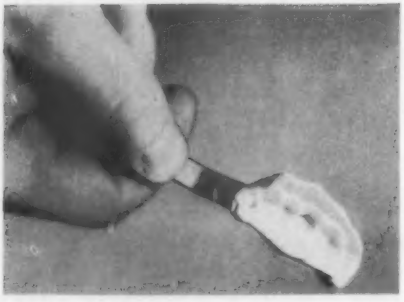

Fig. 4 • Above left: Perforated metal sheet for construction of tray. Above right: Handle attached to tray. Below: Impression made from silicone rubber base material

prepared tray with it. The tray then is seated in the mouth and allowed to remain there for seven minutes.

Removal of the Tray • The tray should be removed by pushing the handle in an upward direction from the lower teeth. If the impression is taken on upper teeth, the tray handle should be pushed downward. The impression should not be removed by holding the tray itself, because there is danger of distortion due to the finger pressure. The impression should show a clear outline of the entire cavity preparation (Fig. 4, below).

Pouring the Cast • The stone model is poured within the first 30 minutes after the removal of the impression from the mouth.

CONCLUSIONS AND SUMMARY

Silicone impression material seems to behave favorably when used together with a copper band in deep-seated proximal cavities. By a reduction in the amount of catalyst added to the paste, the material is made to flow more easily; however, the setting time and the period for developing elasticity are lengthened. These disadvantages can largely be eliminated by subsequent application of material with a much larger catalyst content.

After mixing, the silicone materials continue to polymerize for a considerable period, with the result that they tend to shrink on storage. Distortion can be reduced by retaining the material in trays and copper bands.

An impression technic is here described which makes use of these principles to advantage, and circumvents the necessity for preoperative treatment of the gingival tissues with astringents or vasoconstrictors.

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Psychosomatic Medicine • Although it is neither possible nor desirable to dispense with verbal report in appraising the status of the patient, the clinical investigator takes account of the limitations of verbal report and employs objective criteria of clinical response to therapy when possible. The roentgenogram and hematologic, biochemical and physical measurements, in addition to overt clinical signs and symptoms, provide more critical grounds for evaluating the status of the patient. Even in his use of objective instruments, the investigator must consider the possible effect of suggestion and attitudes upon organic processes. Here is the field of psychosomatic medicine. So many of the interrelationships between the central nervous system and organic processes remain to be explored. Also, all forms of psychotherapy yield successful results with some patients. This poses a problem for the proponents of specific forms of therapy who use favorable results to support a theory or a technic.—*Dwight J. Ingle. Principles of Research in Biology and Medicine.*

The irritational qualities of dental materials

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A simple, short-term screening method for establishing an index to the irritational qualities of materials and drugs used in dentistry has been developed. It consists of the subdermal implantation of dental materials in the rat; as a screening test, this may be preferable to the test use of the materials in cavities in teeth because the new test avoids many factors and variables associated with cavity preparation.

Twenty-two dental materials were implanted in the subdermal connective tissues of rats. After periods of about two days, two weeks and four weeks, the tissues around the pellets were studied microscopically and the inflammatory reactions classified as mild, moderate or severe. Most of the findings correlate well with previous studies involving the dental pulp.

When the technical difficulties encountered in studying the pulps of teeth of human beings or animals are considered, the many currently used dental materials and drugs which contact living tissues that are in use today enumerated, and the ever-increasing number of commercial products for such use recognized, the need for a simple test to determine the relative compatibility of tissues to these materials is readily apparent. This is a report on the development and trial of a simple, short-term screening method for establishing an index to the irritational qualities of a variety of materials and drugs used in dentistry; in particular, it deals with 22 materials or mixtures, most of which are used in operative technics.

The ultimate tool for determining the reaction of the dental pulp to a material placed within a cavity is the human tooth; however, it is very difficult to obtain sufficient numbers of teeth of any specified age at the desired postoperative intervals which have not suffered caries, erosion, or had previous restorative preparations. As a result, the teeth of dogs, monkeys and rats have been employed for such purposes, and the rat molar and incisor have been advocated as a means by which large numbers of filling materials could be treated in short periods of time.[1] But if the tooth of any organism is used for such tests, because of the very nature of the enclosed pulp within the vital dentin, covered in turn by a rather inert enamel, the following problems arise:

1. Secondary dentin deposition is characteristic only of the dental pulp. It is a response to cavitation and probably varies with materials placed within the cavity. If present before a filling is placed, it complicates the interpretation and may mask the pulpal response to different

materials after different periods of time.

2. The depth of a cavity is another variable which affects the pulpal response to cavity preparation or filling material. The fact that before sectioning, the true morphology of the pulp of an individual tooth can only be guessed at makes accurate control of cavity depth at the time of operation difficult.

3. The effects on the pulp of the many varieties and speeds of tooth cutting technics now available are as yet not clear, and such reaction may mask the response to any filling material subsequently placed in the cavity.

4. Filling procedures, such as the physical force of placement of gold foil or amalgam, complicate the picture.

5. The influence of heat or trauma in cavity preparation, or incidental to the setting characteristics of certain materials, may add to the confusion.

6. Marginal leakage, expansion and contraction and the problem of retention of filling materials (especially in the tiny teeth of rodents) also may influence the response of the dental pulp.

7. The time consumed and difficulties attendant on obtaining proper fixation of the dentin-enclosed pulp, and decalcification of the enamel and dentin before sections can be made for microscopic study, may lead to the production of artefacts in pulp tissue which mask the pulp response to a filling material.

8. It has not been practical to study the irritational qualities of some materials such as porcelain or inlay golds in the tooth since cements are invariably in direct contact with the dentin.

9. Lastly, the final interpretation of sections made of pulps subjected to the influence of the afore-mentioned difficulties may vary from investigator to investigator as a result of the superimposition of some of these variables. Many serial or semi-serial sections of a single tooth are required for proper interpretation of the findings. The inadvertent microscopic pulp exposure, especially in small teeth, must be located in this manner, or the interpretation of findings may be false. These factors have led directly to the confusion and controversy so apparent in the literature on this subject. Evaluation of previous studies also is complicated by the fact that there is so much variation in the postoperative time intervals chosen, and few investigations have been concerned with more than two or three different materials tested under the same controlled conditions. The steady introduction of new materials of varying composition makes it mandatory that some means be developed by which these materials can be tested quickly to detect any possible ill effects resulting from their use.

For the reasons cited, it was proposed that if pellets of various materials were implanted directly into the connective tissues beneath the skin of rats and left there for varying periods of time (an "acute" period of 2 to 4 days, and a "chronic" period of approximately 2 weeks) then it would be possible to excise the specimens and surrounding tissues, and after simple fixation and embedding, study microscopically the reaction of the tissues in contact with the implanted dental materials. After a search of the literature was made, heartening results with seven materials in a pilot study[2] were obtained.

In 1933, Dixon and Rickert[3] implanted 14 different materials used for root canal fillings into the subdermal and muscle tissues of rabbits. The tissue reactions to the materials were studied after nearly six months of implantation and were classified accordingly. Copper amalgam was the most irritating, followed in decreasing severity by copper, balsam, rosin, silver amalgam, zinc oxide, silver, silver wire, an unnamed root sealer and baked porcelain. Gutta-percha was implanted for several months in rats and the minimal reaction was described by Boulger.[4] More recently,[5] concurrent with this study, red copper cement, zinc oxide and eugenol plus zinc acetate, tribasic calcium

phosphate, and calcium hydroxide were implanted in the abdominal connective tissue of rats for 24, 48 and 96 hours. The reactions decreased in severity in the same order as the materials are listed. We concur in the statement by Schaad, Carter and Myers[5] that "The use of abdominal connective tissue in rats is offered as a means of mass screening of dental base and restorative materials." In another current study,[6] in which guinea pigs were used, it was shown that:

> Tissue reactions range from a mild foreign body reaction for the polymerized discs of commercial self curing, or thermal curing resins, to a complete necrosis of the implant area, with accompanying loss of the implants of self curing resins containing aluminum merthiolate.

MATERIALS AND METHODS

The 22 materials or mixtures[7] chosen were representative of a variety of materials used in restorative dentistry. On the basis of previous studies, a mixture of zinc oxide and eugenol was chosen as the least irritating, common, temporary filling material. In order to establish the other end of the tissue reaction scale, small amounts of zinc oxide and eugenol were mixed with a drop of croton oil, which is one of the strongest irritants used in experimental pathologic studies[8] and known to irritate the pulp of dogs when placed on fresh cut dentin.[9]

A plastic preforming matrix was used to prepare small cylinders of a uniform size (2 mm. diameter by 2 mm. length) of the various materials which in most instances were mixed and allowed to set in the matrix, removed and implanted. The self-curing acrylic resins, cements, and silicate cements were shaped to the approximate size of a glass slab and some of these were implanted "wet," before setting, and some of them after 24 hours, to see if a difference in reaction was apparent. The gold alloy and gutta-percha were simply trimmed to size, and the porcelain pellets were specially baked and glazed.[7]

Approximately 75 male albino rats (Wistar, Harlan, Indianapolis) were used. After anesthesia was induced with ether and the skin shaved between the scapulae, over the dorsum of the pelvis and over the abdomen, one-half inch long horizontal incisions were made through the skin. The subdermal supramuscular tissues were spread with forceps and the pellets were placed 1 cm. away from the incision which was then closed. Each rat received three pellets of the same material. One rat of each group was sacrificed after 2 to 4 days, one after 14 to 16 days, and in selected instances one was sacrificed after approximately four weeks. At necropsy, about one square inch of skin and connective tissue around and including the embedded pellet was excised and placed in Formalin. After fixation these were embedded in paraffin, sectioned, and stained with hematoxylin and eosin. When extremely hard materials were used, the pellets were carefully removed from their tissue enclosure after fixation. Some of the resin specimens were dissolved out of the tissues in acetone after fixation. The other materials which were soft enough were left *in situ* and sectioned with the surrounding tissues. Whenever problems arose such as exfoliation of the materials due to extreme inflammatory reactions, death of the animal, inability to locate the specimen, or questionable interpretation occurred, the procedure was simply repeated for that particular material or period. In this way, at least six sections of tissue around each of the 22 materials, implanted in triplicate, in 59 rats were studied microscopically. Thus the findings are based on three specimens in one rat for each material-period unless corroboration required the use of more animals. The materials used and the implant intervals are listed in the table.

In interpreting the tissue reaction at the various intervals, the author tried to

Table • Tissue reaction to filling materials

Material	Acute period (2–4 days)	Chronic period (12–18 days)	Long term (26–35 days)
1. Gold foil	Mild	Mild	
2. Inlay gold	Mild	Mild	
3. Silver amalgam	Moderate	Mild	Mild
4. Copper amalgam	Severe	Severe	Severe
5. Porcelain (fused)	Mild	Mild	
6. Resin (fresh, not set)	Mild	Mild	Mild
7. Resin (set)	Mild	Mild	Mild
8. Resin + 2% NaF	Moderate	Mild	Mild
9. Resin + 5% NaF	Severe	Mild	Mild
10. Silicate (fresh, not set)	Mod. to sev.	Moderate	Mod. to sev.
11. Silicate (set 24 hours)	Mod. to sev.	Mild	Moderate
12. Zinc oxide, eugenol	Mild	Mild	Mild
13. Zinc oxide, eugenol, + zinc acetate	Mild	Mild	
14. Zinc oxide, eugenol, + zinc acetate, + calcium hydroxide	Moderate	Moderate	Moderate
15. Calcium hydroxide	Moderate (calcification)	Moderate (osteoid)	Moderate (osteoid)
16. Gutta-percha	Moderate	Moderate	Mild
17. Zinc oxide, eugenol + croton oil	Severe	Moderate	Moderate
18. Zinc phosphate cement	Mild	Mild	Mild
19. Resin cement	Mild	Mild	
20. Red copper cement	Severe	Moderate	Moderate
21. Zinc oxide + eugenol + varnish	Mild	Mild	
22. Silicate + varnish	Moderate	Mild	

be as objective as possible. The gross appearance of the tissues around materials in vivo and after excision was noted. The microscopic findings around the "acute" (2 to 4 days) and "chronic" (usually 14 to 16 days) and long-term periods (usually 28 to 32 days) were recorded according to: (1) types and relative numbers of leukocytes; (2) vascularity of the area; (3) description of membranes, if any, in contact with the material, and (4) relative thickness of the fibrous capsule around the specimens. Then the over-all reaction was recorded as mild, moderate or severe. These classifications of reactions at the various intervals are illustrated in Figures 1 through 3.

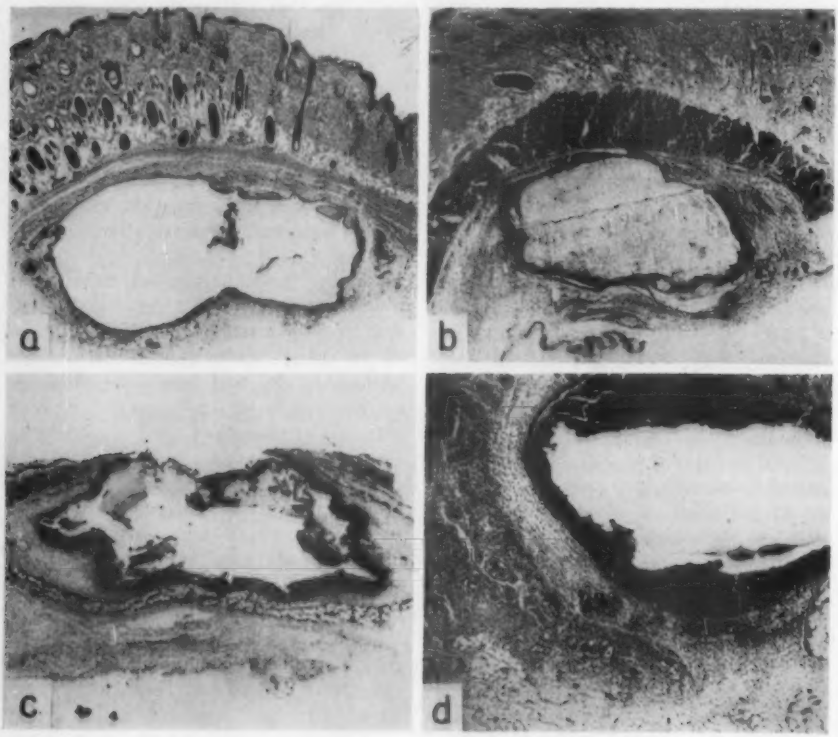
RESULTS AND DISCUSSION

As was anticipated, the reaction to the zinc oxide and eugenol was very mild and the reaction to this mixture plus croton oil was extremely severe. Each of the materials used was surrounded by an acute inflammatory reaction varying in degree from mild to severe after the early interval of 2 to 4 days. In spite of the severity of the acute reaction to many of the materials, it was surprising to find that in most instances the "chronic" (14 to 16 days) reaction was considerably diminished. By and large, the thickness of the capsule in the "chronic" sections was due to fibroplasia, and according to the table this appears to be directly correlated with the degree of acute inflammation around the earlier specimens. In most instances an additional period of approximately four weeks (long term) was used to see if the reaction persisted. (The materials have been listed in arbitrarily chosen groupings in the table as metals; porcelain or silicate cements or self-curing direct filling resins; temporary filling materials; cements; and a cavity

varnish. In most instances the materials are listed within their respective groups according to an ascending order of the degree of severity of the reactions observed.) For purposes of continuity and clarity a brief discussion will be added to the results of the study of each material. For comparison purposes, the excellent and extensive reviews of the literature by Massler[10,11] on the effects of filling materials on the dental pulp will be referred to repeatedly.

Gold Foil • Both the acute and chronic period specimens revealed a mild reaction. The pellet consisted simply of a piece of uncondensed foil. In the early specimen the inflammatory exudate filled the interstices of the foil which had been cut *in situ*. In the later specimen these spaces were filled with fibroblasts and very few lymphocytes. Both reactions were mild, comparable to those illustrated in Figures 1,a and 2,a. James and Schour,[12] after studying the teeth of dogs,

Fig. 1 • a: Photomicrograph showing skin and appendages overlying cavity in which was contained the fused porcelain pellet implanted for two days. Reaction is mild. See very thin fibrin capsule (50 microns), and lack of leukocytes surrounding it. b: Moderate reaction, two day specimen, resin + NaF 2 per cent. The pellet, still in place, is beneath the thin muscle, panniculus carnosus. Fibrin and leukocyte capsule is thicker (150 microns) and leukocytes diffuse into surrounding tissues. c: Severe reaction, two days, zinc oxide and eugenol plus croton oil. Note thick leukocytic concentration encapsuling (300 microns) the specimen, and diffusion of leukocytes into peripheral tissues. d: Severe reaction, two days, resin + NaF 5 per cent. Acute abscess with thick (300 microns) leukocytic capsule and diffusion of leukocytes into overly vascular surrounding tissues. Magnification slightly greater than in c



reported a severe acute reaction of the pulp immediately after placement of the foil filling; however, within 1 to 2 weeks thereafter the pulp had completely recovered, and the original inflammatory reaction was blamed on the trauma of placement of the foil. Their findings correlate well with the findings in the present study.

Inlay Gold Alloy • In both periods the reaction to inlay gold alloy was minor, as denoted by a very thin fibrous capsule and a scarcity of inflammatory cells (comparable to Figures 1,a and 2,a). No studies are available to show the influence of inlay gold alloy alone on the dental pulp presumably because a layer of cement is invariably placed between the dentin and the gold. The tissue reaction found in this study is comparable to that found in relation to the gold foil in this study and indirectly to that described by James and Schour.[12]

Silver Amalgam • The early reaction to silver amalgam was moderate. A thin fibrin layer was in contact with the material which in turn was enclosed by a moderately thin capsule consisting of a diffusion of polymorphonuclear neutrophils and some lymphocytes (comparable to Figure 1,b) with a moderate degree of hyperemia and some black staining of the capsule. The 16 day specimens were classified mild to moderate (comparable to a mixed reaction between Figures 1,a and 2,b). The fibrous capsule contained only a few chronic inflammatory cells. Since the picture had not completely changed to mild by the end of the two week period, an additional specimen was run for four weeks. By this time the reaction was definitely mild (comparable to Figure 3,a). Only a thin fibrous capsule surrounded the material.

This material has been shown in a few experiments involving the teeth of dogs, rats and humans to be only slightly irritating. It may be concluded that embedded, condensed silver amalgam prompts a moderate degree of inflammation around the early specimens which gradually becomes mild. The universal and long-standing use of this filling material would seem to indicate that the early moderate reaction may be disregarded as being of clinical importance.

Copper Amalgam • The reactions to these copper amalgam pellets were indisputably severe in all periods studied. The acute specimens demonstrated the presence of a severe abscess. A thick inflamed fibrous capsule enclosed the specimen and many polymorphonuclear neutrophils were floating free in the cavity as pus (comparable to Figures 1,c or 1,d). The later specimens, when recoverable, presented chronic abscesses enclosed in thick capsules of granulation tissue (Figure 2,c). Massler, in a review of the literature, states that "as far as we can determine, the action of copper amalgam on the pulp has never been studied." This material is seldom used in this country as a filling, possibly because it has proved to be an irritant from the clinical standpoint. The findings agree with an earlier implant study.[3]

Porcelain • Feldspathic fused porcelain beads (glazed) resulted in a very mild reaction. The reaction of the two day specimen is illustrated in Figure 1,a. A very thin fibrin capsule was present, with a very slight diffusion of lymphocytes in the surrounding tissues. The later specimen also proved to be quite inert (comparable to Figure 2,a). The author knows of no studies in which the effect on the pulp of fused porcelain has been demonstrated, again probably because of the fact that it is invariably cemented in place. Dixon and Rickert[3] found a minimal reaction to implanted baked porcelain. It is difficult to propose that the tissue reaction of the pulp could be anything but mild, in the case of this hard, smooth material.

Fresh Silicate • These soft, wet specimens were implanted before the silicate was set to see if the often referred to "free acid" of this material would furnish any untoward reaction. The acute specimen presented a moderate to severe reaction (comparable to a mixed reaction between Figures 1,b and 1,c). A thin zone of coagulation necrosis surrounded the specimen. Polymorphonuclear neutrophils infiltrated a moderately thick fibrous capsule, and plasma cells and lymphocytes were in the surrounding tissues. The 16 day reaction was moderate (Figure 2,b). The four week specimens revealed a persistent, moderately thin fibrous capsule, and the reaction was classified as moderate to severe (nearly comparable to Figure 2,d).

Dry Set Silicate • The dry set silicate pellets were implanted after having set at room temperature for 24 hours. It will be noted that the tissue reaction to this set material is essentially the same as that seen with fresh silicate. In view of the slight differences in reactions at

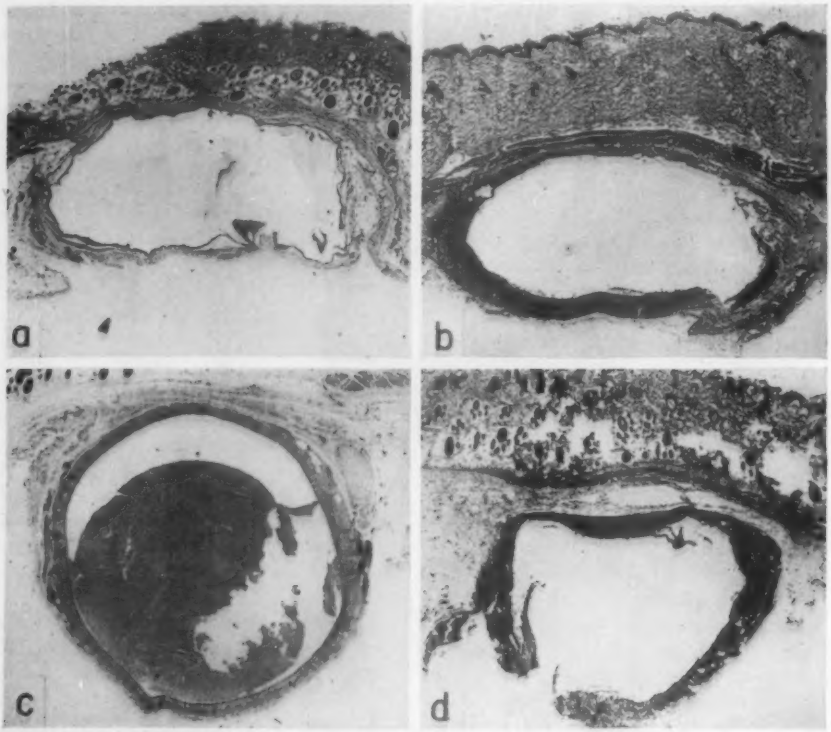


Fig. 2 • a: Mild "chronic" (16 day) reaction. Self-curing acrylic resin. Very thin (20 micron) fibrous capsule and absence of inflammatory cells are notable. b: Moderate 16 day reaction to silicate. Fibrous capsule (300 microns) with some leukocytes incorporated in it is apparent. c: Severe 16 day reaction to copper amalgam. Lower magnification was used so entire abscess could be shown. Thick capsule (450 microns) encloses cavity containing pus. The pellet may have rested in oblong space to lower right. d: Moderate to severe "long term" reaction (28 days) to fresh silicate. Thick (300 microns) fibrous and leukocytic capsule is seen

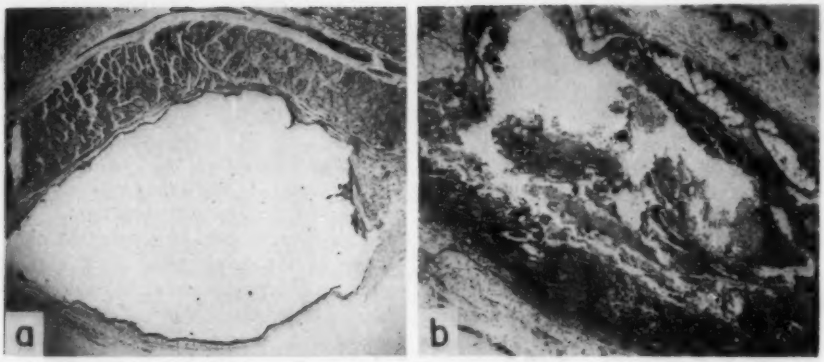


Fig. 3 • a: Mild reaction, 32 days, to set resin. Very thin capsule (20 microns) and lack of reaction are apparent. Compare with Figure 2,a. b: Moderate 16 day reaction to calcium hydroxide. Thick capsule (350 microns) of fibrous tissue and inflammatory cells is most apparent at bottom of specimen. Above, thin broken black line separating specimen from layer of fat proved to be osteoid tissue

the two week and long-term intervals, it may be possible but difficult to say that the set silicate was slightly less irritating than the fresh silicate. With one exception, there is universal agreement among previous investigators that silicate is injurious to the dental pulp.

Fresh Direct Filling Resin • The pellets of self-curing acrylic resin also were placed in the soft, wet state and the inflammatory reactions at the three intervals studied were uniformly mild (comparable to Figure 1,a, and illustrated in Figures 2,a and 3,a).

Set Direct Filling Resin • The tissue reaction to the set direct filling resin pellets was uniformly mild through the three periods studied. Many studies have been made of the effects of self-curing acrylic resins on the dental pulp. It should be remembered that there is a variety of commercial brands of these resins. The methyl methacrylate monomer has been blamed for pulpal injury by some, and yet other resins have shown only mild reactions in the pulp when the monomer was placed directly in the base of the cavity for brief periods. To say the least, the present status of the effects of these filling materials on the pulp is not clear and the results of studies are contradictory. From this study it seems apparent that the resin causes no inflammatory response other than a mild reaction at any period studied. It should be noted that pulp studies in teeth may have been influenced by the excessive shrinkage and lack of adhesion to cavity walls which allow marginal leakage with its attendant variable effects. It is known that the open cavity *per se* promotes a mild inflammatory response in the pulp.[13]

The work of Phillips and Swartz[14] implied that fluoride containing silicate may inhibit recurrent decay, so they felt that fluorides might be incorporated into self-curing acrylic resin and thus increase the value of this material as a restorative agent. This new material was tested as follows.

Resin + 2 Per Cent Sodium Fluoride • This experimental material was made of the mixture of direct filling resin with 2 per cent added sodium fluoride. The acute reaction was moderate in nature because of a diffusion of lymphocytes around the specimen (Figure 1,b). The 16 day specimen revealed a mild reaction (comparable to Figure 2,a) as

did the long-term specimen (comparable to Figure 3,a).

Resin + 5 Per Cent Sodium Fluoride • This material contained 5 per cent sodium fluoride. It caused a severe, acute reaction. An abscess was formed and the relatively thick capsule contained many polymorphonuclear neutrophils (Figure 1,d). The specimens at the later intervals were uniformly mild (comparable to Figures 2,a and 3,a). This study illustrates the potential value of this screening method for newly proposed materials for restorative purposes. The extreme toxicity of locally embedded sodium fluoride has been demonstrated by Traicoff[15] who inserted a pellet beneath the skin of guinea pigs. The result was massive necrosis, immediate, over a large area of approximately 4 sq. in., such that the microscopic tissue reaction around this embedded material could not be studied. It may be inferred that a resin which incorporates 5 per cent or more of sodium fluoride may be approaching dangerous ground as far as the dental pulp is concerned.

Zinc Oxide and Eugenol • The zinc oxide and eugenol specimens at the three intervals studied revealed a mild reaction comparable to that seen in Figures 1,a, 2,a and 3,a. This is in agreement with previous work involving the dental pulp.

Zinc Oxide and Eugenol + Croton Oil • Several specimens from this portion of the study were lost by exfoliation because of the extreme inflammatory reaction to the croton oil. The intact specimens on microscopic study revealed acute abscess formation at 4 days (Figure 1,c) and a moderate inflammatory reaction at 16 days and 32 days (comparable to Figure 2,b).

Zinc Oxide and Eugenol + Zinc Acetate (5 per cent) • These specimens revealed uniformly mild reactions at both intervals studied. Apparently the zinc acetate does not unfavorably influence the reaction to zinc oxide and eugenol, a finding in agreement with previous reports.[5,11]

Zinc Oxide and Eugenol + Zinc Acetate (5 per cent) + Calcium Hydroxide (25 per cent) • The early reaction to this material was moderate. Among the fibroblasts of the moderately thick capsule were polymorphonuclear neutrophils, lymphocytes and plasma cells. There was a wide zone of coagulation necrosis next to the implant. The 16 day and 32 day specimens revealed a moderate reaction as represented by a thick capsule of granulation tissue (reactions comparable to Figures 1,b and 2,b).

Calcium Hydroxide • The calcium hydroxide was mixed with water and allowed to set for a few moments into a fragile pellet, then implanted. The tissue reactions at the three intervals were consistently moderate in nature. A zone of coagulation necrosis immediately around the material was present in the four day specimens and a rather thick inflammatory and fibrous capsule was seen. Some pathologic calcification of the subdermal muscle bundles of the panniculus carnosus was noted. In the 16 day specimen a thick fibrous capsule was present. There was considerable osteoid tissue deposited within the capsule in close association with fat tissue (Figure 3,b). The four week specimen revealed the continuation of a moderate reaction and the presence of osteoid and associated giant cells. This phenomenon of pathologic calcification and the deposition of osteoid material has been investigated further and reported on separately.[16] The relationship between this osteoid production and the deposition of a "calcified bridge" over a pulpal exposure treated with calcium hydroxide is intriguing.

The addition of a minor amount of a strong irritant such as croton oil to the

bland mixture of zinc oxide and eugenol proved to be disastrously irritating. The addition of zinc acetate to the zinc oxide and eugenol mixture apparently does not influence the irritant qualities of these drugs; however, when calcium hydroxide is added to the zinc oxide and eugenol and zinc acetate mixture, a moderate, persisting inflammatory reaction results, which is comparable to that seen as a result of the calcium hydroxide alone. It is interesting to note that when calcium hydroxide has been mixed with zinc oxide and eugenol, no stimulation of osteogenesis was seen.

Zinc Phosphate Cement • Zinc phosphate cement, placed as set pellets, caused a uniformly mild reaction comparable to that seen in Figures 1,a and 2,a. Many earlier studies have shown that severe pulp reactions have resulted from the use of these cements; however, at least one study implies that no ill effects result. In the studies reviewed by Massler,[10] changes due to these cements varied from no change, in shallow or deep cavities, to severe localized inflammatory changes under cavities without regard to depth. This confusion again points up the extreme difficulty in controlling all the variables attendant on study of materials placed in dental cavities. From this study there is no evidence that this material produces anything but a mild reaction during the periods studied.

Temporary Stopping • The tissue reaction from temporary stopping at the early interval was moderate, with a capsule of varying thickness of fibrous tissue and a diffusion of lymphocytes (comparable to Figure 1,b). At the two week interval, the moderate reaction was represented by a thin capsule, but some evidence of granulation type tissue was seen (comparable to Figure 2,b). After the long-term period the reaction was quite mild (comparable to Figure 3,a). Several studies have shown that rather severe hyperemia and inflammation appear in the pulp of the tooth filled with temporary stopping. Traditionally, it is inserted into the cavity while hot. It is well-known that the marginal seal of this material is poor; therefore, the reported effects may have been due to leakage and heat and not to the reaction to the material itself; nevertheless, in this study it was found that this material alone does prompt a moderate inflammatory reaction.

Resin Cement • Set pellets (24 hours) of resin cement revealed a mild reaction at both intervals studied. Langeland[17] has described unfavorable pulpal reactions to three cements tested in 29 human teeth for periods of time ranging up to 133 days. He suggests that the inflammatory changes may be irreversible, yet only one tooth showed actual necrosis, of a pulp horn, at two days, and all other pulps survived various intervals up to 133 days. Also, he suggests that the poor marginal seal of the resin cements may have contributed to the severity of the pulpal reactions. These materials need further study.

Red Copper Cement • Here again, a very severe reaction to red copper cement was seen at the early interval characterized by a thick capsule which was part fibroblast, part fibrin, with early abscess formation represented by polymorphonuclear neutrophils and other leukocytes within the cavity (comparable to Figure 1,d). At the two week and long-term intervals, the reaction was moderate in nature with a slightly inflamed, fibrous capsule comparable to that seen in Figure 2,b. This material has been studied by several investigators and is generally believed to be quite irritating. It has not remained popular as a clinical material. These findings would appear to be in complete agreement with those of this study.

A Cavity Varnish • Pellets of zinc oxide and eugenol were allowed to set and then were dipped in the varnish (a natural gum in a solvent) which was allowed to set in air, and then implanted. By deduction, since the reaction to zinc oxide and eugenol alone is mild, it is apparent that the tissue reaction to the varnish is either mild at both intervals studied, or its irritant influence has been nullified by the zinc oxide and eugenol.

Set silicate pellets were dipped in the liner, allowed to dry in air, and implanted. Here the early reaction was moderate. A zone of coagulation necrosis around the specimen was like that described for fresh and set silicate. However, the two week specimens furnished a mild reaction with a few foreign body giant cells noted in some regions, similar to the mild reaction at this interval seen in the case of the set silicate alone. It would seem that the varnish, which appears to be rather inert itself, did not succeed in protecting the tissues from the irritational qualities of the set silicate. It has been shown that this type of varnish does not provide effective protection for the pulp against the action of silicate fillings.[18, 19]

GENERAL DISCUSSION

The subdermal implantation of dental filling materials in the rat in order to study their irritational qualities may be preferable as a screening test to the actual test use of the materials in cavities because of the avoidance of such factors as marginal leakage, expansion and contraction, galvanism, trauma associated with cavity preparation, condensation and many other variables. There appears to be a reasonable degree of correlation between the present findings and those of previous investigators who studied the dental pulp. It seems worthy of note that calcium hydroxide, which is often placed directly on the exposed living pulp, invariably prompts a moderate inflammatory reaction, and even silver amalgam at the early interval prompts a moderate reaction. Since these materials appear to be clinically feasible, it might be concluded that any filling material which promotes nothing worse than a moderate reaction may be acceptable. Or it might be more wise to recommend that, all other conditions being equal, the least irritating materials should be used.

It becomes apparent that differences in the toxicity of a variety of commercial compounds employing drugs in varying combinations may well produce different reactions; therefore, 12 different commercial brands of pulp capping and cavity lining materials were surveyed by this method and the findings further prove this point. There is a wide difference in reaction to the different commercial brands.[20] The work by Zawawi[20] demonstrates the reliable reproducibility of this test.

This method may well be used in studying the effects of different types and degrees of glaze on porcelain appliances, as well as different types of alloys and cements, oral surgical pastes, periodontal packs, implant denture materials, and antibiotics. Therapeutic, cauterizing, and antiseptic solutions also may be studied through modifications of this method. Liquids may be injected and the gross and microscopic changes may be observed. Solutions also may be compared to one another after they have been mixed into a paste with kaolin (or some other supposedly "inert" material) and a pellet formed and implanted. Such studies are in progress.

Calcium hydroxide, magnesium hydroxide, and plaster of paris have a peculiar osteogenic potential which other drugs studied do not.[16] No one can say how important this characteristic is to pulp preservation.

The irritant effects of sodium fluoride and croton oil appear less in later specimens. All the materials studied became encapsulated and relatively less irritating

in time, so we believe the intervals used were fortunate choices as compared with those used in the earlier studies in which multiple monthly periods were used.[3, 4]

The final answer to various specific questions regarding the effects of different filling materials on the pulp must rest on studies of such materials placed in human teeth under controlled conditions. This answer will be a long time coming, because of the difficulties and shortcomings of such studies described earlier; meanwhile this test should be a valuable screening method for testing many materials, in order to establish biologic standards to be met by such substances.

SUMMARY AND CONCLUSIONS

Twenty-two dental materials were implanted in the subdermal connective tissues of rats. Some were implanted as fresh wet mixes as well as in the set state. After periods of about 2 days, 2 weeks and 4 weeks the tissues around the pellets were studied microscopically and the inflammatory reactions to the materials were classified as mild, moderate or severe. This served as a simple, short-term screening test to determine the relative irritational qualities of these materials used in restorative dentistry. The test is applicable to many other drugs or materials.

The following substances resulted in uniformly mild reactions: gold foil, inlay gold, fused porcelain, a direct filling resin, zinc oxide and eugenol and zinc acetate, a zinc phosphate cement, a resin cement, and a cavity varnish.

The following substances resulted in some moderate reactions: silver amalgam, a direct filling resin plus sodium fluoride (2 per cent), zinc oxide and eugenol plus zinc acetate and calcium hydroxide, calcium hydroxide alone, gutta-percha, and a silicate (implanted wet and set).

These materials presented severe reactions: copper amalgam, copper cement, a resin plus 5 per cent sodium fluoride, and a control material of zinc oxide and eugenol plus croton oil.

Most of the findings correlate well with many previous studies involving the dental pulp, although some of the materials have not been tested before, and there are many contradictory reports in the literature concerning them. It is believed that this controlled study of many materials, with relatively few variables, helps to clarify the knowledge of the irritational qualities of these materials.

A trial of a self-curing resin filling material with added sodium fluoride is presented as an example of the efficiency of this test for simple screening of the many newly proposed materials.

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Individual copper band rubber base impressions for inlays and crowns

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Four years of clinical experience with rubber base impression materials, plus two laboratory projects in which over 500 impressions were made, have convinced the author that rubber base impression materials compare favorably with reversible hydrocolloid in accuracy of cavity reproduction. Rubber base impression materials are not a substitute for reversible hydrocolloid in the office equipped and ready at all times to use the latter material. Rubber base impression materials may be better suited for the office where only a few individual crowns or inlays are made each week. A technic for single tooth, copper band impressions for individual crowns or inlays is described.

The mercaptan-base rubber impression materials now used in dentistry were introduced to the profession in 1953. The material is usually marketed in two tubes—the base material being white and the accelerator or catalyst, brown. Skinner[1] reports that one popular brand of material consists of an accelerator in one tube composed primarily of lead peroxide, a small amount of sulfur and about 17 per cent castor oil used as a plasticizer. The other tube usually labeled "base" consists primarily of polysulfide rubber, with some zinc oxide and calcium sulfate included. When equal amounts of the base material and accelerator are mixed together, an irreversible reaction takes place and a tough, elastic synthetic rubber results.

SELECTION OF BRAND OF MATERIAL

According to Phillips,[2] the dental manufacturers of the present rubber base impression materials depend on the same common source for the polysulfide polymer, but may not use the same system of curing and brands of material may differ

in some respects. However, Schnell and Phillips[3] have also stated that "although there are slight differences in the accuracy of various brands, the selection of a particular product probably should be based on handling characteristics such as ease of mixing and proportioning, setting time, flow and tackiness rather than the inherent accuracy." The experience in the laboratory and clinics at Loyola University, New Orleans, has been almost exclusively with one brand of material, but some laboratory experimental projects would seem to support this statement.

ADVANTAGES AND DISADVANTAGES

It is the opinion of the clinic staff, based on four years of clinical experience and more than 500 impressions of steel dies and preparations cut in porcelain and Ivorine teeth, that the accuracy of cavity reproduction, when using rubber base materials, is consistently superior to that obtained with any other indirect impression material with the exception of reversible hydrocolloid. Schnell and Phillips[3] would seem to support this opinion with the statement that "as a group, the five rubber base materials, when the double mix technic was used, showed less variation in results and less distortion on storage" than did a series of impressions made with a group of five widely known hydrocolloids. They also stated that "the initial accuracy was comparable to that obtained with the two best reversible hydrocolloids."

The elastic properties are much better than are those of hydrocolloids. This means that the synthetic rubbers have much better ability to resist rupture or tearing when the impression is removed from the mouth.

The dimensional stability of synthetic rubber is far superior to that of hydrocolloids. However, the report of Schnell and Phillips[3] indicates the material is not as dimensionally stable as has been claimed by some. Impressions should not be stored for hours or days before the die is constructed if the most accurate result is to be obtained.

An important advantage is that little equipment is needed to try this type of impression material.

The gingival margin of the cavity preparation must be exposed and be plainly visible if a satisfactory impression is to be obtained, but this is the same prerequisite for obtaining good hydrocolloid impressions. It is difficult to make rubber impressions if access is poor or if the preparation cannot be kept dry while the material is being placed. The material has an unpleasant odor when being dispersed on the mixing tablet, and the mixed material has a dirty brown color. Towels and clothing are permanently stained if soiled with the material before it has "set."

USES

The rubber base impression materials are not a substitute, at this time, for reversible hydrocolloid if the hydrocolloid is used in a properly equipped office which is prepared at all times for its use. However, the introduction of the rubber base materials is a contribution to dentistry because of their accuracy and the fact that complicated technics are not necessary to obtain good results. Rubber base materials may be best suited for the office in which only a few inlays or crowns are made each week.

The material can be used in a tray to take an impression of one or more preparations or in a copper band for a single tooth impression. Sturdevant[4] and others have reported a technic for making tray impressions.

LABORATORY OBSERVATIONS

In August 1954 an MOD preparation was made in a porcelain tube tooth, as suggested by James.[5] Two master castings were made for this preparation. A copper

band technic was used to obtain approximately 100 rubber base impressions of the tooth. The copper bands used covered the entire crown of the tooth, but fit loosely enough to allow approximately 1 mm. of rubber between the band and the tooth at the height of contour on both the buccal and lingual surfaces. The top of the band was closed with compound and approximately 3 mm. of space left between the compound and the highest point on the occlusal surface of the tooth. The outside of the bands was strongly reinforced with compound and the inside thoroughly scoured with an inverted cone stone.

Single mixes of rubber base material were used. A portion of the mix was flowed into the cavity preparation. The band was filled with material, placed on the tooth and left until it was certain that setting had taken place. Stone dies were constructed using one of the well-known die materials, and finger pressure was used to seat the master castings on the dies. The word "accurate" in describing the fit of a casting is relative and it is realized that a casting considered accurate by one person might seem inaccurate to another. However, when the master inlays were placed on the dies and examined with the aid of a dissecting microscope, it was apparent that this new impression material was consistently more accurate than any other available impression material with the possible exception of reversible hydrocolloid, and the results indicated that clinical trial was merited.

Another laboratory project in which over 400 impressions were made has been completed recently. The tray technic with a double mix of material, and the individual copper band technic with both double and single mixes, were used to obtain impressions of various steel dies and preparations. These included the MOD Bureau of Standards type of steel die, a tapered cylindrical steel die, four types of complex preparations in Ivorine teeth and the MOD preparation in the porcelain tube tooth. The results again were of such a nature as to reconfirm our previous observations regarding the comparative accuracy of the material.

CLINICAL EXPERIENCE

Our clinical experience with rubber base materials has been largely limited to copper band impressions of single preparations using a brand of material manufactured for a single mix technic. One reason for this is that temperature and humidity are factors which influence setting time of rubber materials. Our school is not air-conditioned and the geographical location predisposes to high temperature and humidity for a large part of the year. In the earlier days of our experience with a tray and double mix technic, too rapid setting of the brand of material being used was a serious disadvantage and the single mix impression technic was more satisfactory under the conditions mentioned. Brands of material are now available with a liquid retarder which prolongs the working time when the temperature and humidity are high. However, we have continued to use the individual copper band technic in our clinic even though too rapid setting is no longer a serious problem with some brands of material.

Although Schnell and Phillips[3] reported that a double mix procedure increases the initial accuracy of the impression, our clinical and laboratory experience would indicate that a single mix of rubber base is more accurate than other impression materials available for a single tooth impression and it is felt that there is a place for a single mix, individual copper band technic.

INDIVIDUAL COPPER BAND TECHNIC

Selection of the Band • Unannealed, stiff, 36 gauge copper bands should be

used. Thin or soft bands may be deformed by external or internal pressure when the impression is removed from the tooth, which results in permanent distortion of the enclosed rubber impression.

A band is selected which fits the tooth loosely. It is essential that a sufficient amount of rubber be present between the band and the axial surfaces of the tooth in order to take advantage of the elastic properties of this material. The band should not be too large since shrinkage increases with increased bulk of rubber.[3] However, in most instances it would be difficult to use a band so large as to influence significantly the accuracy of the impression from a clinical standpoint.

Preparing the Band • With a full crown the band is trimmed so as to cover the whole preparation and extend slightly past the gingival margins. In MOD preparations the band may cover the entire tooth if it fits loosely, and if the tooth does not have excessive undercuts on the buccal and lingual surfaces. If the band fits tightly or if excessive undercuts are present, it is best to festoon the band so that it does not cover too much of these undercut areas, because this material does have an elastic limit. In MO or DO preparations, the band may cover most of the crown of the tooth but should be trimmed so it will not be forced between the proximal surface not involved in the cavity preparation and the adjacent tooth.

The inside of the band is roughened with an inverted cone stone or preferably painted with rubber adhesive. Distorted impressions may result if this step is neglected because set rubber will not adhere to smooth surfaces of a copper band.

The outside of the band is reinforced with impression compound on the buccal and lingual surfaces and the compound placed over the top opening. The band is placed on the tooth while the compound is still soft so as to be sure that the band will seat properly. At this time, some of the excess compound can be molded over adjacent occlusal surfaces if it is desirable to have a stop and a guide for seating the band when taking the impression. It is essential that trays or bands be rigid when used to take rubber base impressions, and the purpose of the compound reinforcement of the sides of the band is to eliminate any possibility of distortion. The space between the compound top and the highest point on the occlusal surface of the tooth should be about 3 mm.

Exposing Gingival Margins • Proper exposure of gingival margins is not a difficult problem since cotton string impregnated with 8 per cent epinephrine has become commercially available. The tooth should be isolated with cotton rolls and dried. One or more thicknesses of string are packed between the tooth and soft tissue at the gingival margin in order to displace the tissue and stop bleeding. The string is forced to place with the blade of a small plastic instrument.

Dispensing the Material • Three-quarter inch lengths of base material and catalyst are dispensed on a paper mixing pad. Small differences in the proportions of material apparently do not influence results significantly, but dispensing will be more accurate if the brown material is dispensed first because it maintains its shape better than the white material.

Mixing • The small amount of rubber needed for copper band impressions can be mixed easily with a cement spatula. Mixing can be accomplished quicker if in the beginning the brown material is picked up with the spatula and placed on top of the white. Spatulation will take 30 to 45 seconds. It is important to spatulate until the material is homogeneous in color and all white or brown streaks are eliminated.

Taking the Impression • The string is removed from the gingival crevice. Some

of the material is picked up from the mixing pad with the blade of a no. 2 Woodson or similar plastic instrument. The material is flowed into the preparation in the same way that soft cement is flowed into a preparation. This procedure is repeated until all cavity walls and margins are covered. The band is filled and seated firmly over the tooth.

The impression should be held in place until the rubber has set, and is removed with a direct pull rather than a rocking motion. It has been suggested that impressions should remain in the mouth about two minutes after the apparent set of the material for the greatest accuracy.

DIES AND ARTICULATORS

The die may be poured with any acceptable stone die material or may be silver plated. An articulator can be constructed by one of the acceptable technics.

SUMMARY

1. Rubber base impression materials compare favorably with reversible hydrocolloid in accuracy of cavity reproduction.

2. The accuracy of various brands of material is approximately the same and the selection of a brand probably should be based on handling characteristics.

3. Up to the present the material is not a substitute for reversible hydrocolloid in the office properly equipped and ready at all times to take reversible hydrocolloid impressions and may be better suited for the office where only a few individual crowns or inlays are made each week.

4. Rubber base material may be used in a tray for single or multiple impressions or in a copper band for impressions of single preparations.

5. A technic for single tooth, copper band impressions for individual crowns or inlays has been utilized in the Loyola University, New Orleans, dental clinic.

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Effect of Suggestion • The effect of suggestion upon the percepts, the concepts, and the behavior of the investigator is of similar importance. We tend to see and to report those things which we hope to find. The experimenter may search more diligently for laboratory errors and other grounds for discarding data when the results are at variance with the anticipated results than when they are in agreement. . . .

By the use of the double-blind placebo (a method which conceals from patients and doctors alike the identities of recipients of drugs under test), it is possible to control the tendency of the investigator to overlook the natural tendency of most patients to improve (the self-limitation of diseases) and to control any bias that the physician may have for the drug under study.—*Dwight J. Ingle. Principles of Research in Biology and Medicine.*

Radiation in dental offices

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To determine where the dental profession is today in regard to reducing radiation hazards, a survey was conducted among dentists in the larger centers of population. Of the 117 x-ray machines examined, 43 (36.8 per cent) had filters added. The average thickness of these filters was 0.75 mm., as compared to the recommendation of the National Committee on Radiation Protection of 1.5 mm. Average output was 1.11 r per 100 milliampere seconds. Films in most common usage required an average of 1.5 seconds per exposure. Thus, the average dental roentgenogram, made in the offices surveyed, delivered about 1.7 r to the jaw. This is about one-third as much as previously required.

During recent years there has been increasing concern over man-made radiation and its possible effects on mankind. Recommendations for maximum permissible dosages have been reduced.[1] Articles in dental journals, clinicians at dental meetings and teachers at dental schools have urged the addition of aluminum and copper filters, lead collimators and modifications of technic, so that the danger of excessive radiation in dental offices would be reduced.

That a radiation hazard exists is widely recognized in both lay and scientific circles, and the magnitude of it is subject to conjecture on a scale just as wide. Methods of reducing this hazard have been widely publicized in dental journals.[2-5] So, although there has been a deluge of information on this danger and how to reduce it, there has been a dearth of information on what current practices are. Perhaps it is for this reason that some cities and states have deemed it necessary to legally register radiation equipment.[6-8] It would be desirable for the dental profession to police itself.[9] Dentists should be concerned since more dentists use x-ray machines than all other practitioners combined.[10]

PURPOSE OF SURVEY

In order to reduce the lack of information on the output, leakage, collimation and filtration of the "average" dental x-ray machine, and to find out what speed dental film was in most common usage, and thereby determine where the dental profession is today in regard to reducing radiation hazards to the minimum practical limits, it was decided to conduct a survey in selected areas where no legislative controls are in effect.

It was thought that such a survey would reveal current progress toward reducing radiation hazards, as well as indicate what areas of a radiation reduction program need more emphasis. The

survey would also perform the valuable service of furnishing the selected dentists with specific information about patient and personnel protection in their offices.

It has been obvious that some confusion exists among dentists in their efforts to comply with recommendations, partly because the literature is sometimes too technical to be easily interpreted, and partly because there are areas of disagreement among authors. The purpose of this survey was to reduce such confusion.

METHOD

Selection of dentists was determined by the need to cover the largest number of offices in the shortest possible time; for practical purposes, this meant visiting professional and office buildings in the larger centers of population. The selected dentists were queried by direct mail as to whether they would cooperate in such a survey.

Table 1 • X-ray machines tested

Make	Model	Number	% of total
Ritter	A	7	6.0
	B	28	23.9
	D	10	8.5
	E	1	.9
		46	39.3
Weber	Raydex	37	31.6
	90	1	.9
		38	32.5
General Electric	E-CDX	10	8.5
	70	4	3.4
	90	1	.9
		15	12.8
X.R.M.	1A	1	.9
	3A	3	2.7
	90	1	.9
	OR-30	1	.9
		6	5.1
Victor		5	4.3
Phillips	Oralix	5	4.3
Fischer		2	1.7
Totals		117	100.0

X-ray machine output was measured with a factory calibrated Victoreen 200 mr Minometer, with pocket ionization chambers 32 inches from the target and in the center of the primary beam. The findings were then extrapolated to a distance of 8 inches.

Leakage was checked by moving the 200 mr pocket ionization chambers behind the machine and 90 degrees to each side of the machine on a horizontal plane, as well as in a semicircle with a 1 meter radius.

The make and model of each x-ray machine was recorded regardless of whether it was functioning or not. The type of periapical film in general use in each office was recorded and its speed noted.

The pointer cone was removed and each machine examined to determine the added filtration. If a lead collimator was present, its aperture diameter was measured. Then, with the room darkened and the collimator and pointer cone in place, a calcium tungstate plate was placed at the end of the cone in a plane perpendicular to the primary beam. A short exposure was made, which indicated on a transparent plastic ruler the diameter of the beam at the tip of the cone.

Distribution of Machines • Ritter and Weber x-ray machines were encountered more than twice as often as all other makes combined (Table 1). The percentage of Ritter machines closely approximates the 39.3 per cent found by Richards[11] in a similar survey in Michigan. Both surveys also show that among the new machines, the GE-70 is seen most often, although the sample is too small to be significant.

Filtration • Recommendations of the American Academy of Oral Roentgenology[12] require total filtration equivalent to 2 mm. of aluminum for dental x-ray machines. The National Committee on

Radiation Protection suggests filters equivalent to 1.5 mm. of aluminum.[1] Trout, Kelley and Cathey[13] advise the equivalent of 2 mm. of aluminum for machines with 50 to 70 kilovolts peak (kvp), 3 mm. of aluminum for machines with 70 to 100 kvp, and 0.25 mm. of copper for machines with above 100 kvp.

Richards does not advocate, but does cite data for a machine equipped with an equivalent of 2.25 mm. of aluminum.[14] With this much variation, it is no wonder that confusion exists.

Of the 117 machines examined 43, or 36.8 per cent, had filters added. The average thickness of these filters was 0.75 mm., or an average of 0.275 mm. for all machines. Average inherent (built in) filtration was 0.8 mm., based on manufacturers' information. If 2.0 mm. can be called a standard, the average deficiency of total filtration per machine is about 0.9 mm. Total filtration in four machines in the survey exceeded 2.0 mm.; one had 3.0 mm., one had 2.75 mm., one had 2.5 mm., and one had 2.25 mm. Nineteen machines had 2.0 mm., which is in compliance with recommendations.

Richards' survey,[11] conducted a year before this survey and in another area, found only 11.5 per cent of the machines had added filters, or 25.3 per cent fewer than were found in this survey.

Machine Output • Measurements of output were taken at a distance of 32 inches from the target and extrapolated to 8 inches, corresponding to the patient's face. All dentists visited use a short cone technic. Filters were in place when readings were made. Data were normalized for 10 milliamperes and 65 to 70 kvp.

Average output was 1.11 r per second (11.1 r per 100 milliampere seconds). The lowest measurement was 0.20 r per second, taken on a Ritter D model with 2.0 mm. total filtration. The highest was 1.68 r per second, taken on a Ritter B model with 0.5 mm. inherent filtration and none added.

Table 2 • Speed and current usage of dental x-ray films

Film	Speed rating	% of users
Kodak		
Radia-Tized	$\frac{1}{2}$	63.4
Ultra-speed	$\frac{1}{6}$	8.5
Regular	$\frac{1}{8}$	1.4
DuPont		
Lightning Fast	$\frac{1}{7}$	1.4
Double coated	$\frac{1}{2}$	11.3
Single coated	1	1.4
Rinn		
DC	$\frac{1}{8}$	7.0
EF	$\frac{1}{5}$	1.4
Minimax		
Intermediate	$\frac{1}{8}$	1.4
Fast	$\frac{1}{5}$	1.4
International (IFI)	$\frac{1}{8}$*	1.4

*Estimated.

The average output of 1.11 r per second lends little credence to the statement often quoted by the lay press, "The average dental x-ray delivers 5 r . . . to the jaw."[15] This refers to Etter's publication,[2] citing work done by S. S. Sidhu. Etter's own work showed an even greater dose of 6.4 r per exposure, using 65 kv. peak and 20 ma. and no added filter.

Films in most common usage require an average of 1.5 seconds per exposure (Table 2). According to this survey then, the average dental roentgenogram delivers about 1.7 r to the jaw. This is about one third of the amount reported by Etter and Sidhu. The discrepancy may result from several things. It would be desirable to think it is caused by progress made by the dental profession during the past two years. Partial credit is, no doubt, due to doubling of the speed of Kodak films. I admit that measurements were made quickly with, no doubt, some sacrifice in accuracy. Also, the Minometer's response at lower energy levels tends toward greater inaccuracy, but filtration reduces this error. In addition, it is recognized that this instrument was designed primarily for personnel monitoring around million volt installations.

How or why the discrepancy exists is not so important as the apparent fact that in the area covered by the survey, the dental radiation hazard appears to be much less than that previously reported. It also suggests that the most feasible route for reducing radiation hazards in medicine and dentistry may be through professional education rather than lay legislation.

In the survey, the machine with the greatest output (1.68 r per second) could be used with the slowest dental film listed in Table 2 and expose the jaw to about 5 r per average exposure.

Leakage • Recommendations of the National Bureau of Standards are that leakage radiation in diagnostic x-ray machines shall not exceed 0.1 r per hour, measured at a distance of 1 meter.[1]

It should be pointed out that all machines tested, regardless of age or model, exhibit a measurable degree of radiation in all directions if the distance is reduced to zero. This should absolutely prohibit an operator from holding the pointer cone or the tube housing at any time that the machine is in operation.

Of the machines examined, only the Ritter Model A registered leakage in excess of recommendations. The highest leakage rate measured was 6.0 r per hour.

Collimation • Recommendations of the American Academy of Oral Roentgenology[12] are that the primary beam be collimated by a lead diaphragm with an aperture of such size as to limit the diameter of the beam to 2.75 inches at the tip of the pointer cone. The National Committee on Radiation Protection is not specific but says, "The radiographic field should not be larger than clinically necessary."[1]

The average beam diameter of all machines in the survey was 3.29 inches, an excess of 0.54 inches per machine. The average area was 8.5 square inches, an excess of 3.56 square inches per machine, indicating a possible reduction of 41.9 per cent of the area of the radiation field.

The smallest beam measured was 1.375 inches in diameter, in a Weber Raydex Model 6A; the largest was 4.5 inches in diameter, in an XRM Model 3A. Richards' survey showed that only 14.0 per cent of machines had lead diaphragms.[11] The present report indicates definite improvement in this area.

Film Speed • Recommendations[12] are to use "ultra-fast" film. Current usage is illustrated in Table 2. The speed rating is based on manufacturers' suggested exposure times and on very limited clinical investigations, and is at best only approximate. It is expressed as the fraction of time required for exposure as compared to DuPont Single-coated Film. It is interesting to note that the slowest and the fastest films in Table 2 are produced by the same manufacturer. The fastest and the slowest films are not in common usage. Also, the fastest films cited in Table 2 are not being used because of increased target to film distances.

The need is clearly indicated for a standard exposure index for dental x-ray films, to avoid some of the confusion that exists relative to film speeds and brand name designations. It is heartening to learn that progress is being made in this direction.[10]

Structural Shielding • In no office visited was there a need for shielding, provided the usual precautions of distance and direction from the patient are adhered to. All dentists were aware of these precautions. Some were advised to secure longer timer cords, but in no instance was the need critical.

SUMMARY

1. It has been shown that disagreement exists in estimating the magnitude of the radiation hazard in dentistry, and

in recommendations for its reduction and control.

2. It is suggested that radiation dose to the patient may be as little as one-third as much as previously reported.

3. Dental personnel in general are cognizant of and are adhering to recommended safety rules for personnel.

4. The need for standard exposure indexes for dental x-ray films has been noted, and reported to be available in the immediate future.

5. The dental profession is making rapid progress toward reducing radiation hazards to the minimum practical limits, in an area of the country where no legislative regulation is in effect.

6. The need is apparent for a critical evaluation of all exposure factors which will result in the greatest reduction of radiation hazards compatible with the least sacrifice of diagnostic quality.

7. It appears that the most feasible way to reduce radiation hazards may be the education of dentists in the principles and technics of such reduction, rather than legislation.

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The Genesis of Concepts • It is generally assumed that knowledge of the external world comes only through the senses. The perceptual organs of man are sensitive to only a small proportion of the energy manifestations around him, and unaided perceptual processes do not permit precise quantitative measures of mass and energy even when they fall within the sensory range. . . .

Most concepts of the external world are not based upon direct experience but upon some form of symbolic information, usually language. Man is not directly aware of gaps or limitations in sensory range or conceptual span. Sensations are perceived as closed patterns, and concepts become satisfying meanings. It is generally true that man adjusts to information of the external world by either excluding it from consciousness (directing attention elsewhere) or attaching a satisfying meaning to it. A scientist may remain unsatisfied with apparent meanings and seek new data and concepts, but being a scientist does not exclude the possibility of his being logic-tight and complacent even in his own field of interest. . . .—*Dwight J. Ingle. Principles of Research in Biology and Medicine.*

cases and comments

THE SURGICAL CEMENT INLAY AS A TEMPORARY FILLING

By Martin H. Berman, D.D.S., Floral Park, N. Y.

One of the most frequent procedures in daily dental practice is the insertion of temporary fillings in prepared cavities. For many patients, the interval between visits may be an uncomfortable and trying time; cavities may become sensitive, mastication may be impaired, or a hastily inserted filling may wear away or even become dislodged.

The ideal material for use as a temporary filling material is still to be perfected. Generally, gutta-percha or some type of zinc oxide-eugenol preparation has been employed. Although gutta-percha is widely used and is easy to handle and insert, histological studies show that this material can induce pulpal inflammation. In use, gutta-percha fillings offer little resistance to wear, and become dislodged readily. The rubbery consistency of gutta-percha permits pressure to be exerted on the inner dentin should the gutta-percha filling be compressed. Even the act of inserting the filling results in considerable pressure on the floor and walls of the cavity.

Temporary fillings of zinc oxide-eugenol, although they provide a measure of patient comfort, usually require the use of a bur, or strong digging action, for removal. This subjects the patient to further trauma and may alter the cavity preparation.

An ideal temporary filling material would possess the following qualities: (1) ease of insertion, (2) freedom from pain, (3) no effect on pulp, (4) ease of removal without the use of a bur, and (5) possible reutilization.

A material for temporary fillings which has afforded the author a gratifying measure of success is Ward's surgical cement, pink, quick setting. Any material of similar composition may be employed. The following technic is recommended:

1. The surgical cement powder is mixed with a sufficient number of drops of the liquid to produce a mass large enough to fill the prepared cavity. The mass is spatulated to a medium heavy consistency while fibers of absorbent cotton are incorporated into the mix to bind it into a transportable mass.
2. The mass is carried to the cavity and pressed gently into place with a cotton pellet dampened with sweet oil (olive oil, U.S.P.)
3. The patient is instructed to close his jaws until the mass sets.
4. When the cement mass has set, it is removed with a sharp sickle. The mass now is a surgical cement inlay.
5. The inlay is held between the fingers and any excess material is trimmed with small crown shears.
6. A fresh, light bodied mix of surgical cement is prepared. Cotton fibers are not incorporated in this mix. The fresh cement is applied to the surfaces of the inlay that will be in contact with the surfaces of the cavity. The inlay is placed in the cavity and the patient is instructed to close his jaws in occlusion.
7. When the cement applied to the inlay has set, the excess material is trimmed with a cleoid or discoid instrument. Articulating paper is used to check for high spots, which are carved away with the instrument or with a dull round bur. The bur should not be used near the margins of the inlay.
8. The patient is dismissed.

The surgical cement inlay serves perfectly as a suitable temporary filling. At the subsequent visit the inlay may be removed with a sharp instrument. It will not stick to the cavity walls. If removed carefully, the inlay will come out in one piece and may be recemented to place if required.

Two Whitney Avenue

editorials

Association fortified financially:
House votes raise in annual membership dues

The Association enters its second century financially fortified, for a few years at least, by an increase of ten dollars in membership dues. The increase, which raises annual dues to thirty dollars, was voted by the House of Delegates at the Centennial Session in September, and becomes effective January first of next year. The fifty per cent increase was approved with little debate, no fanfare and with few dissenting votes. The unanimity of opinion expressed by the delegates speaks well for the official family of the constituent societies in keeping members informed of Association activities, obligations and financial needs.

It speaks well, too, of the levelheadedness and understanding of the members who recognize that the Association cannot function in a vacuum but that it faces the same inflationary problems faced by the rest of the nation.

It has been ten years since the Association has raised its dues. In January 1951 they were raised from twelve to twenty dollars. Since then, despite steadily increasing costs and steadily depreciating dollars, the Association's activities and services have steadily mounted, the result being that the respectable nest egg which the Association was able to lay away annually during the early years of this decade by now has become an empty shell.

How much longer inflation will continue, and at what speed it will proceed, only economists—certainly not dentists—can estimate. For some 215 years, ending in 1934, it has recently been reported, prices inched up about one half of one per cent a year. Since then prices have zoomed. Between 1934 and now they have doubled. From 1941 to 1946 the Consumer Price Index, issued by the Bureau of Labor Statistics, rose from 62.9 to 102.8—4.1 points per year. From 1947 to 1948 the index jumped from 95.5 to 102.8. In 1951 it rose to 111. Between 1951 and 1957 it rose to 121, and by the middle of 1959 it had risen to 124.8. In short, from 1941—the beginning of World War II—until 1959 the cost of living index rose 61.9 points averaging 4

per cent a year. If the rise in the cost of living continues at the same rate for the next decade, things now costing $1.00 will cost $1.48 or almost 50 per cent more.

The nation, it seems, has come to accept an increase of 2 to 3 per cent a year in the cost of living as a normal but necessary evil. In fact, some economists insist such "creeping inflation" is essential to national prosperity. No dentist may be certain that this premise is sound. But one thing dentists may be certain of: if yesterday's economic trends continue into tomorrow—as likely they will—both the Association and its members must be prepared to provide increasing services in a steadily expanding economy. Consequently, while the ten dollar raise in dues, which becomes effective January 1, 1960, will enable the Association to discharge its obligations satisfactorily for a few years to come, it will not suffice indefinitely. Unless the cost of living levels off and wages and prices cease to spiral, another raise in dues can be anticipated before the end of another ten years.

The first International Conference on Dental Journalism and Documentation

The International Conference on Dental Journalism and Documentation, one of several international conferences held in conjunction with the recent Centennial Session of the Association and the annual session of the Fédération Dentaire Internationale, had the unique distinction of being the first of its kind ever held in the dental world. It was the first to bring together dental editors and librarians from many countries—in this instance, from 24 countries—to discuss problems of mutual interest.

The papers, presented by authors from nine nations, were uniformly excellent, and their reverberations will be felt for years to come. Key problems of dental journalism and documentation were discussed, and various solutions proposed.

Some of the most helpful proposals came from the librarians. Mrs. Ida Marian Robinson, associate professor of library science at the University of Maryland, drawing on the experiences of dental and medical librarians in the United States and Canada, reddened the faces of dental editors by pointing up, in a kindly fashion, a number of weaknesses found too often in dental publications. Both dental editors and readers of their publications will benefit substantially if Mrs. Robinson's proposals are put into effect.

Equally thought provoking were the comments of Wesley J. Dunn, former editor of the *Journal of the Canadian Dental Association*. "The function of the editor," stated Dr. Dunn, "is a tangible and serious obligation. It is a position requiring professional leadership of the highest caliber. Not only are the thoughts, the ideas, and the beliefs he expresses on his editorial page important, but that which he permits others to say in the body of his journal will have the greatest influence on the welfare of his publication, the association it represents and the readers whom it serves. . . . There is no group within our profession which contributes more to the betterment

of dentistry and hence to the welfare of the people we serve than do those of you to whom are entrusted the spokesmanship of our profession and the midwifemanship of its literature. . . ."

Problems of an international dental journal, of abstracting, and of editing for readers with different languages, were rewardingly discussed by Professors Stone, Miles and Korkhaus, respectively. The afternoon symposium on documentation, moderated by G. Gysel of Belgium, dealt specifically with the intricate problems of indexing. Contributors from five different countries participated.

It is an understatement to assert that at the conclusion of the conference the editors understood better the work of the librarians, the librarians understood better the work of editors, and that each gained insight into his respective field.

How soon circumstances will permit the holding of a second international conference on dental journalism and documentation time alone will tell. It is hoped that it will not be too far in the future. The interchange of ideas which such a conference permits, the better understanding which it fosters, the mutual respect which it engenders and the friendships which it creates not only benefit dental journalism and dental practice but contribute to better international understanding and hence to world peace.

Another Relief Fund campaign gets under way

Once again comes that time of the year when the Council on Relief launches its annual Relief Fund drive—a drive to collect at least one hundred thousand dollars to be added to the Association's benevolent Relief Fund. The income from the Fund is used to ease the financial stress of destitute dentists or their families. It is hoped that by the time this issue of THE JOURNAL reaches you that you will have responded to the Council on Relief's invitation to contribute to the current drive and that your response took the shape of a good sized check. If you have not as yet responded, please do so now as your help is sorely needed by a growing number of practitioners far less fortunate than yourself.

During the past two years there has been a tendency on the part of some members to be less liberal in their donations. Also there has been a tendency in some states not to make relief grants in relation to applicants' needs. Unquestionably the latter tendency results from the former. In short, because the state relief funds are limited, only limited relief can be given the needy. To alleviate this situation the House of Delegates, last September, approved a resolution submitted by the Council on Relief which permits the payment—for a trial period of three years—of a "bonus of one-quarter of the total amount contributed by members of a constituent society in the annual relief fund seal campaign to that society provided that the constituent society (1) attains the quota assigned to it for the previous year by the Council on Relief and (2) pays out in grants the previous year a sum greater than was received as a regular refund which was shared on an equal basis with the American Dental Association Relief Fund."

This latest liberalizing of the program assures donors that a larger share of their donations may be returned to their state for the benefit of their own associates who are in need. It also will enable some of the less affluent constituent societies to increase the amount of their relief grants.

The Association's Relief Fund program is the only one of its kind conducted by a national professional organization. Every few years new provisions are added which increase its benefits and enhance its value. Fundamentally, however, the soundness of its structure depends on the annual contribution of Association members. The Council on Relief and the recipients of relief depend on you. Don't let them down. If you haven't contributed as yet this year do so now. Use the envelope which the Council on Relief has sent you for that purpose or send your check to the Council on Relief, American Dental Association, 222 East Superior Street, Chicago.

Fred W. Conover, Iowa dentist, shares centenary spotlight with the Association

Fred W. Conover, Winneshiek County, Iowa, born dentist, observes his one hundredth birthday on the sixteenth day of this month. The Association, which also celebrates its centennial this year, takes this occasion to send its fellow centenarian best wishes and felicitations.

An 1890 graduate of Philadelphia Dental College, Dr. Conover practiced almost continuously in Decorah, Iowa, from the year of his graduation until 1930. An active contributor throughout his professional life to matters pertaining to dentistry, he also found time for civic affairs, having served on the Decorah City Council and as mayor of Decorah for several years. He is a life member of the Iowa Dental Association, former member of the Iowa State Board of Dental Examiners and a former member of the American Dental Association. A member of the Elks, Odd Fellows and Masons, Dr. Conover, as he approaches his one hundredth birthday, is blessed with an active mind, keen memory and far better health than many of far younger years.

It is one thing for an organization such as the American Dental Association to achieve a hundred year history—an achievement of which the Association is justly proud; it is quite another for a member of the profession to achieve that distinction. Therefore, as the year 1959 draws to a close, the Association draws aside so that Dr. Fred W. Conover—fellow centenarian—may enjoy to the fullest the center of the centenary stage and the bouquets which his years of service to society entitle him.

international correspondence

News from Great Britain

The printing strike being over, the July issues of the *British Dental Journal* have been published in one volume, and we in Great Britain are delighted to receive our *Journal* once again. The issue is devoted largely to the Royal College of Surgeons L.D.S. Centenary Celebrations. It features an editorial headed "The influence of the Royal College of Surgeons of England on dentistry" and contains a paper by Sir Wilfred Fish entitled "A profession in the making" which should be read by all those interested in the future of the dental profession wherever they may practice. Sir Wilfred presents some challenging and controversial thoughts many of which are applicable to dental education and practice throughout the world. Sir Wilfred deals especially with the relationship between dentistry and medicine during the past century and with reference to Great Britain states, "Its real significance lies in its bearing on our duty to the public; and in these days of the Welfare State this can only be properly discharged if our relations with medicine as well as our own internal professional organization are as perfectly understood and as flexible as they can be made.

"It so happens that it is in these matters of public health that we are constantly coming into official contact with our medical colleagues and we should be wise to take advantage of their long experience and good will in trying to set up our own schemes to secure positive dental health for the rising generation. In doing so we should gain both experience and authority."

Sir Wilfred concludes his paper by suggesting that "If we make our own plans and hammer them into shape in consultation with our medical colleagues and in cooperation with the administration, we shall have earned the right to be allowed to carry them through ourselves on our own responsibility." He writes "Our purpose must be to increase still more our usefulness to the community . . . and . . . a useful instrument to promote this further development would be to establish a consultative panel by virtue of its membership would be fully informed concerning the internal structure and possible development of each of the different departments of professional life to which reference has been made. Such a body should not only reflect every facet of dental activity but might usefully include representatives of the basic sciences, of medicine and even of lay opinion. Their collective wisdom would be made available in the form of memoranda or reports, not by formal resolutions."

CHILDREN'S DENTAL HEALTH

W. Stewart Ross, chairman of the Dental Health Committee of the British Dental Association, writes: "The Memorandum on the Dental Health of Children produced by the British Dental Association has met with general approval by those bodies responsible in the United Kingdom for the general health of the children. Seven hundred and fifty copies have so far been published and a further 1,000 copies are on order."

This memorandum is a successor to a similar document drawn up by the British Dental Association in 1954, and intrinsically the recommendations and advice remain the same. The memorandum stresses the need for more dental research and dental health education, and there is a chapter referring to fluoridation of the water supplies. Copies of the memorandum have been sent to all foremost organizations and departments who "have it within their power to assist by direct or indirect action in the achievement of the memorandum's ob-

jectives." Since regular dental inspection and early treatment of dental defects must always rank as one of the most important aspects of correct oral hygiene, the memorandum rightly stresses this prerequisite among the principal measures for safeguarding and improving the dental health of children.

Unfortunately the acute shortage of dental manpower in the United Kingdom makes this advice somewhat naïve, and certainly impracticable, since the ultimate success of the memorandum's appeal would lead to a widespread need for dental treatment which could not be met by an already overworked profession.

However, the memorandum's appeal for dental health education, in which the public are asked to care for their children's teeth by correct nutrition, eating habits and hygiene of the mouth, is direct and praiseworthy. Here indeed there is an immense field for propaganda, sustained and widespread, which should reach every home, every school and institution. Once again, such an aim is impractical unless sufficient funds are available for the propaganda. The British Dental Association have always looked to the Government to provide the necessary funds, considering that it is the Government's responsibility to educate the community in correct oral hygiene habits. Whether the Government eventually will respond remains to be seen. However, steps are now being taken to provide more dental schools and the extension of existing ones, and this step of the Government will mean at least that more dentists will be trained to meet a demand which up until a few years ago had not gone much further than emergency work and the provision of dentures.

THE NATIONAL HEALTH SERVICE

From a review supplied by W. Senior, Chief Dental Officer of the Ministry of Health of the Report of the Ministry of Health, 1958, the following points are of interest:

The total cost of the financial year 1958 of the services provided for England and Wales amounted to about £626,000,000 which was £41,000,000 more than in the previous year and the Exchequer met about £480,000,000 of this amount. The main increase was £23,000,000 in the cost of hospitals and specialist services.

A total of 9,882,812 courses of dental treatment were given during the year (9,119,527 in 1957). This welcome growth in treatment has been brought about partly by a steady, though small, increase over recent years in the number of dentists taking part in the Service, and partly by the capacity the profession has shown to undertake more work to meet the growing demand for dental treatment. The trend for increased conservation of children's teeth gained further and gratifying impetus in 1958 but most forms of conservative treatment continued to increase. Steadily increasing use is being made of x-rays as an aid to diagnosis, also a reflection on the greater emphasis on conservation wherever possible. In all about 9,920,000 teeth were extracted, a 4.6 per cent drop from the previous year (10,400,000).

The number of dentists in the Service at the end of 1958 was 10,274, of whom 521 were women, a net increase of 118 over the beginning of the year.

SCHOOL DENTAL SERVICE

In the annual report for 1958 of the Principal School Medical Officer of Leeds, an important university and manufacturing city in Yorkshire with a population of approximately 500,000, D. E. Taylor, the Principal School Dental Officer, is quoted regarding a survey of dental health in 12 to 14 year old Leeds School children.

The object of the survey was to obtain information about the distribution of ill-health, and to assess the efficiency of the school dental service in Leeds.

The report states: "Of all the permanent teeth which had erupted by the age of 12 years, 28 per cent had been attacked by dental decay. Of the first permanent molars, which erupt at 6 years, 80 per cent had been affected. Only 1.5 per cent of children were caries-immune, and only 6 per cent of children were dentally fit. The average number of decayed teeth was between 6 and 7 per child.

"By the time children left school at 15 years, 32 per cent of all erupted teeth had decayed. Less than 2 per cent of children were found to be dentally fit and the average number of decayed teeth per child was between 8 and 9. Of the first permanent molars 90 per cent had been attacked.

"Whereas there are no comparable figures available in Leeds over past years, evidence exists which shows that the incidence of dental caries in 12 year old school children has almost doubled since World War II.

"Next in importance to the treatment of dental decay is the treatment of malocclusion, and brief reference should be made to this problem. It was found that only 44 per cent of all children had a normal occlusion and hence 56 per cent of all children were potentially needing orthodontic treatment.

"Dental decay is undoubtedly associated with the stagnation of food on tooth surfaces. One would expect, therefore, that the practice of

good oral hygiene would reduce the incidence of dental decay. It was found, however, that no correlation existed between good oral hygiene and dental decay in this age group, and hence it would appear that those factors influencing dental decay are far more powerful than any inhibiting effect of oral hygiene as practiced by the child. There was, however, a very strong and positive correlation between good oral hygiene and the health of the gum tissue; those with cleaner teeth had healthier gums."

The survey was carried out on 1,184 school children at four grammar schools, eleven secondary modern schools, one private school and one special school.

ITEMS OF INTEREST

Replying to a question in the House, Mr. Walker-Smith, Minister of Health, said that the total amount spent last year on dental research in the United Kingdom was "at least £54,000." He stated that the "chief difficulty . . . is not lack of funds but lack of interest and enthusiasm on the part of both dental and scientific graduates." He added that the salaries paid were equivalent to those of other academic medical research workers, but did not mention how few were the senior posts available in dental research.

The Ministry of Health have issued a new poster and picture set intended for the use of local authorities in the dental education of the public generally and of children and their parents particularly.

In the new poster a toothpaste tube and brush stand in a sentry box with the message "Teeth Matter! Guard them well." The set of four illustrations provides guidance on dental hygiene and care, and pictures those foods which build teeth and those which exercise them. The fourth picture has the arresting caption "Be true to your teeth and they won't be false to you."—*G. H. Leatherman, D.M.D., F.D.S., R.C.S., F.A.C.D.*

News from Chile

Chile, a long, narrow country on the southwestern coast of South America, now has a water fluoridation program in full swing. Chile, a country of 7,000,000 inhabitants, has a population of seven persons per square kilometer.

In 1952 a committee on water fluoridation was appointed by the government. Among its members were health engineers, physicians, dentists and representatives of the Rockefeller Foundation. As president of the Colegio de Dentistas de Chile, an organization similar to the American Dental Association, to which all practicing dentists must belong, I became a member of this committee. A comprehensive plan was approved to start a fluoridation program.

The School of Public Health completed the technical studies. We, the dentists, laid down the basis for a dental examination of all children of 3, 6 and 12 years of age in two towns located near Santiago, the capital city of the country. To this end we sent out two teams with instructions to perform examinations thoroughly and with the same detailed care in both cities.

The fluoridation of the water supply system was started in the town of Curicó, with a population of 10,350, on September 1, 1953. The other city, of similar size, was left as a control.

Both cities had practically no fluorides in their drinking water supplies. In northern Chile, by comparison, the rate of fluorides runs between 0.2 and 0.8 ppm, but in the central and southern part of the country this rate falls to from 0.005 to zero. Fluorides in the proportion of 1.0 ppm were added to the water at Curicó, the formula recommended by the American, Dr. H. Trendley Dean, and others.

In 1956 the first survey made showed a remarkable reduction in the incidence of caries among the children under 6 years of age. In Curicó, where the fluoridation was installed, there are now twice as many children aged 3, 4 and 5 years immune to dental caries in comparison to children of the same age in the control town, the nearby San Fernando.

Our Public Health Service is now working on a vast nationwide fluoridation plan with a yearly cost of 99,000 escudos (1 escudo is equivalent to 1 dollar). The ingredient used is sodium silicate fluoride, which must be imported at present. The cost per person of the whole program has been figured at $0.15.

The development of this plan is going steadily forward and at this writing the water systems of communities as far apart as Punta Arenas, the southernmost city in the world, and Talca, in the center of Chile, among others, have been fluoridated.

It is estimated that within a year from now approximately 65 per cent of the inhabitants of Chile will be drinking fluoridated water.

In the name of my colleagues and of the Chilean people I wish to present our grateful congratulations to the American dental pioneers who developed these fluoridation programs for the benefit of our future generations.

Raúl Muñoz Inza
Santiago, Chile

news of dentistry

Obed Moen new president of FDI; 30 countries represented at 47th annual meeting

Obed H. Moen, Watertown, Wis., formerly vice-president of the Fédération Dentaire Internationale, was elevated to the presidency at the 47th annual meeting of the organization in New York, a session held concurrently with the Centennial Session of the American Dental Association. He succeeded Thure Brandrup-Wognsen of Sweden.

Other officers of the federation are: vice-presidents, J. Délibéros, France; Le-Roy M. Ennis, United States; Knut Gard, Norway; E. Müller, Germany, and W. Stewart Ross, United Kingdom; Belgian legal representative, C. Gysel; councillors, R. Braun, Germany; D. W. Gullett, Canada; E. Goia, Italy; secretary general, G. H. Leatherman, United Kingdom; treasurer, J. Stork, The Netherlands; speaker of the General Assembly, H. Freihofer, Switzerland; editor, H. H. Stones, United Kingdom; assistant secretary, W. Riis Klausen, Denmark, and assistant treasurer, Miss D. Parrott, United Kingdom.

Elected with acclamation to the list of honor were A. Joachim of Belgium, who was made vice-president of honor; J. Carol Montfort of Spain; J. W. Knutson, Assistant Surgeon General and chief dental officer of the U. S. Public Health Service, and Harry Lyons, past president of the American Dental Association.

In addition to the delegates, alternates

Obed H. Moen

Hans Freihofer is seen in the top picture directing the first General Assembly of the 47th annual session of the Fédération Dentaire Internationale at the Manhattan Hotel, New York. The lower picture shows some of the delegates from the 30 countries represented. In the foreground is J. Stork, The Netherlands, FDI treasurer.

and observers from 30 FDI member countries, observers at the session were present from the World Health Organization, the European Organization for Research on Fluorine and Dental Caries Prevention, the Comité International de Médicine et de Pharmacie Militaires, and the following nonmember countries: Cuba, Ghana, Haiti and Taiwan.

A manual of organization and procedure for the General Assembly was approved. This manual was prepared by a committee composed of Harold Hillenbrand, secretary of the American Dental Association, H. Freihofer and K. Gard.

The Council of the FDI decided that a history of the organization, from 1900 to 1960, should be produced as an important contribution to the future of the federation, with C. F. L. Nord, president of honor, as the official historian. A subcommittee of the publications committee composed of Dr. Nord, Lon W. Morrey, editor-in-chief of the American Dental Association, H. H. Stones and G. H. Leatherman has been set up to deal with production of the history in all its aspects.

At its opening meeting the General Assembly accepted as full members the Ceylon Dental Association, the Korean Dental Association and the Confédération Nationale des Syndicats Dentaires of France. Affiliate membership was ap-

proved for ORCA, and a corresponding membership from the Uniao Odontologica Brasileira. The federation at present has 53 full member associations and seven corresponding member associations in 48 countries.

The 1960 meeting of the FDI will be held in Dublin, Ireland, the 1961 meeting in Helsinki, Finland, and the 1962 session in Cologne, Germany.

FORMER F.D.I. SEC.-GENERAL M. F. WATRY DIES AUG. 28

At the opening meeting of the general Assembly of the Fédération Dentaire Internationale in New York September 12, one minute of silence was observed in honor of the memory of M. F. Watry, who died at his home in Brussels August 28.

Dr. Watry was a former secretary-general of the FDI and also a vice-president of honor of the Federation. He was the recipient of many honors from his own and other countries and had recently been paid tribute by the leading members of the dental profession of the world on the occasion of the celebration of his 50th year in professional life.

Association Affairs

BEST SCIENTIFIC EXHIBITS GIVEN CENTENNIAL AWARDS

The most extensive scientific session in the history of the Association was considered highly successful by the committee in charge. Members of the committee were David J. Fitzgibbon, chairman, J. Malcolm Elson, Donald R. Mackay, Walter Monia and Jarvis Williams.

An unusual feature of the program held during the Centennial Session at the Coliseum in New York was that almost one fifth was presented by dentists from abroad.

Members of the Fédération Dentaire Internationale Council were pictured as they held their first meeting preliminary to the 47th annual session in the Manhattan Hotel, New York. They are, reading clockwise from lower left, Hans Freihofer, Switzerland; Enrico Goia, Italy; Don W. Gullett, Canada; Obed H. Moen, United States; Prof. H. H. Stones, United Kingdom; C. Gysel, Belgium; Knut Gard, Norway; Miss D. Parrott, United Kingdom; J. Stork, The Netherlands; C. F. L. Nord, The Netherlands; T. Brandrup-Wognsen, Sweden; G. H. Leatherman, United Kingdom; Miss M. Barker, United Kingdom; Miss J. Ellis, United Kingdom, and W. Riis Klausen, Denmark.

Fairleigh Dickinson University awarded honorary degrees of Doctor of Laws to two outstanding members of the Association in September. The recipients were Percy T. Phillips (second from right), immediate past president, and Gerald D. Timmons (second from left), dean, School of Dentistry, Temple University, and speaker of the House. At the left is Walter A. Wilson, dean, Fairleigh Dickinson School of Dentistry, and at the right is Dr. Peter Sammartino, president of the university.

Judges of the scientific exhibits were Laverne H. Jacob of Peoria, Ill., George B. Larson of Chicago and Seymour J. Kreshover of Bethesda, Md.

First place winner in the federal agencies category was "General anesthesia in ambulatory dental patients" by the National Institute of Dental Research, National Institutes of Health, Department of Health, Education, and Welfare, under the direction of Francis A. Arnold, Jr., Bethesda, Md. Second place went to "What do you know about high speeds?" by the Army Dental Corps under the direction of Joseph L. Bernier, Washington, D. C. Winner of the third award was "Protein metabolism and oral disease," by the Veterans Administration Hospital, Brooklyn, under the direction of Philip Person, Brooklyn.

In the category of institutions, associations, state and local governments, first place winner was "Are you a pathologic gambler?" by the New York Institute of Clinical Oral Pathology, Theodor Blum, secretary. Second place winner was "Practical dental caries prevention" by the Indiana University School of Dentistry, Joseph C. Muhler. Third place went to an exhibit on dental research at the New York University College of Dentistry under the direction of Earl O. Butcher.

Award-winning exhibits by individuals were as follows: "The intramucosal insert: A method for stabilizing difficult dentures" by A. Norman Cranin, Brooklyn, first place; "Cleft palate rehabilitation" by W. H. Olin, Iowa City, second, and "Criteria for and treatment of some congenital defects" by Lyon P. Strean and Eugene P. Leoni, Norristown, Pa., third.

A Certificate of Honor was given to the Colgate-Palmolive Company for an exhibit on toothbrushing instruction in primary classrooms under the direction of J. E. deWever, Jersey City. The exhibit was the result of a research project undertaken by the Eastman Dental Dispensary of Rochester, N. Y., in cooperation with the company.

Special commendation was given to the United States Navy Dental Corps casualty treatment program under the direction of C. W. Schantz, Washington, D. C. Special mention also was awarded to a historical exhibit by the American Academy of the History of Dentistry, and to an exhibit on their centennial contributions to dentistry by the Seventh District Dental Society and the Rochester (N.Y.) Dental Society under the direction of Ralph S. Voorhees, Jr., and Sherwin M. Morris, Rochester.

ALL SCHOOLS PARTICIPATE IN STUDENT CLINIC PROGRAM

All of the 47 dental schools of the United States sent a student to New York to participate in the first Centennial Student Clinic Program sponsored by the Association's Council on Membership. The program was supported by a grant from The

Winners in the Centennial Student Clinic Program are, left to right, Barvo N. Walker, Baylor University, first prize; Raymond S. Murakami, Howard University, second prize, and Dan E. Moss, University of Nebraska, third prize.

Dentists' Supply Company of York, Pa.

After the presentation of their table clinics on September 14 at the Coliseum, the student clinicians journeyed to York by chartered bus for a tour of the company's factory and research facilities. A dinner was held at the York Country Club in honor of the students, and the three prize-winning participants were awarded honors.

First prize winner of a $300 cash award was Barvo N. Walker of Baylor University, for a clinic on esthetics and proper physiological function in prosthodontics. Second prize of $200 went to Raymond S. Murakami of Howard University for his clinic on impression and restorative procedures using rubber base materials. The third prize cash award of $100 was given to Dan E. Moss of the University of Nebraska for his table clinic on anatomical gold castings.

JOURNAL HAS NEW POLICY ON REPRINTS OF ARTICLES

Beginning with the October 1959 issue of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, authors of scientific articles which are published therein will be provided with 100 reprints of the article free of charge with the compliments of the Association.

STATE SECRETARIES TO MEET, HEAR RESULTS OF SURVEY

A summary of the findings of a recent survey of component society activities will be given at the 11th State Secretaries Management Conference November 19-21. The sessions will be held at the Central Office of the Association in Chicago.

The general theme of the program will be the component society in the structure of organized dentistry and as an agency of community service, according to Louis M. Cruttenden, assistant secretary of the Association, and chairman of the conference.

In addition to the analysis of the survey of component societies, which will serve as the basis of a program of proposed action for all such societies in the future, there will be discussions of administrative programs, initiation of relief fund grants, ethics and disciplinary procedures, development and expansion of hospital dental services, dental student recruitment programs, dental health programs, the dentist-patient relation and the component society's role in relation to dental laboratories.

It is planned to use the material presented at this conference as the basis of a manual for the use of component societies.

CONFERENCE ON CLINICAL TRIALS OF DENTAL DRUGS

A conference on clinical trials of dental drugs will be held Wednesday, March 16, 1960, in the auditorium of the American Hospital Association building in Chicago. The conference is sponsored jointly by the Council on Dental Therapeutics and other agencies of the American Dental Association and by the American Association of Dental Schools.

The primary purpose of the conference is to provide the Council on Dental Therapeutics with the best available basis for the evaluation of drugs considered in its acceptance program. In addition, such

a conference may provide a definite set of principles for the guidance of manufacturers who wish to determine the usefulness of their drugs in dentistry, increase the number of dental investigators with competence in the area of clinical trials, and encourage a critical attitude that may result in more effective use of drug and treatment procedures in dentistry.

The participants in the conference will include appropriate representation from as many dental schools and other related institutions as possible and from the manufacturers and distributors of drugs used in dentistry.

Among the speakers will be I. B. Bender, Neal Chilton, Sidney Epstein, R. M. Grainger, Stanley C. Harris, Ph.D., Thomas J. Hill, Frank J. Orland, Floyd D. Ostrander and David Weisberger.

Lester W. Burket, chairman of the Council on Dental Therapeutics, and Harry Lyons, dean of the Medical College of Virginia School of Dentistry, will act as moderators.

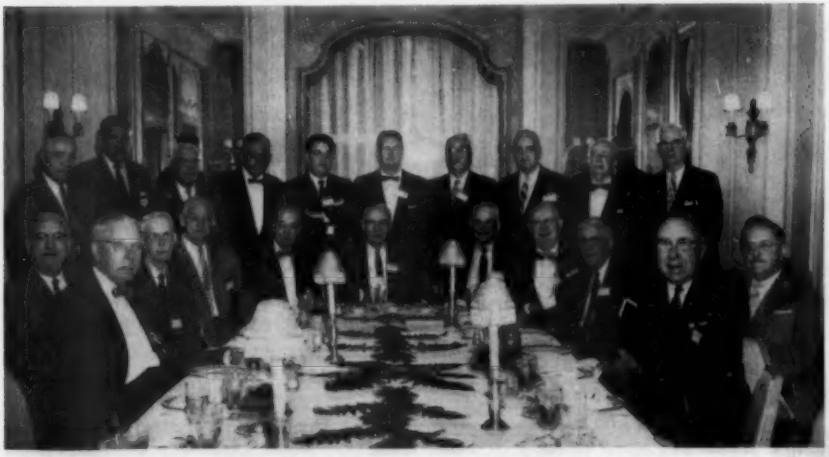
HILLENBRAND SPEAKS IN NORWAY, FINLAND, DENMARK

Three representatives of the Association attended the 75th anniversary observance of the Norwegian Dental Association in Oslo October 14-17. They were Harold Hillenbrand, secretary, Obed H. Moen, president of the Fédération Dentaire Internationale, and LeRoy M. Ennis, a vice-president of FDI.

Dr. Hillenbrand spoke at the session on the problems connected with fluoridation of drinking water in the United States. He also was invited to lecture at the Finnish Dental Society in Helsinki and the Royal Dental College in Copenhagen, Denmark.

BUREAU PUBLISHES TWO COLORFUL NEW BOOKLETS

Two new booklets, one for children and one for adults, have been produced by the Association's Bureau of Dental Health Education.



All of the 21 living past presidents of the Association were present at the Centennial Session and attended a luncheon Tuesday, September 15, at the Waldorf-Astoria Hotel. From left to right: (seated) H. B. Washburn, Leroy M. S. Miner, Marcus L. Ward, J. Ben Robinson, Philip E. Adams, Roscoe H. Volland, Clyde E. Minges, LeRoy M. Ennis, Sterling V. Mead, C. Willard Camalier and C. Raymond Wells; (standing) Bernerd C. Kingsbury, Harry Lyons, Frank M. Casto, Oren A. Oliver, Leslie M. FitzGerald, William R. Alstadt, Harold W. Oppice, Daniel F. Lynch, Arthur H. Merritt and Otto W. Brandhorst.

"I'm Going to the Dentist" is a picture story in two colors, with brief captions, of a child's first visit to the dentist. It can be read to a small child by a parent, or primary school children should be able to read and understand it by themselves. There is a foreword to parents.

Prices are: (25) $1.50, (50) $2.65, (100) $4.75, and (500) $22.56.

"Artificial Dentures—a Health Service or a Health Hazard" explains why the skills and knowledge of a dentist are required to provide satisfactory dentures. It warns the public of the hazards involved in obtaining dentures from those persons not qualified by education or licensed by law to make dentures.

Prices are: (25) $0.75, (50) $1.40, (100) $2.25, and (500) $10.

Both booklets can be ordered from the Order Department, American Dental Association, 222 E. Superior St., Chicago 11.

Percy T. Phillips, left, immediate past president of the Association, and Robert W. McCluggage, Ph.D., inspect one of the advance copies of "The History of the American Dental Association" of which Dr. McCluggage is the author. A limited number of the books, hand-bound in advance of the regular press run, were presented to dignitaries at the Centennial Session.

LIBRARY BUREAU ISSUES LIST OF PACKAGE LIBRARIES

Members of the American Dental Association are entitled to the use of the following facilities of the Bureau of Library and Indexing Service:

A basic collection of 12,000 volumes including all the most recent dental books in English and numerous selections in other languages.

All current dental journals published in the United States and abroad that can be acquired.

A collection of 2,000 package libraries on 700 topics.

Individual reference services.

Lists of publications.

Consultive service in nomenclature and history.

The Bureau has published a new listing of books published during 1956-59 and of the package libraries available, together with instructions for the procedure to be followed in ordering any of these.

This pamphlet is available free of charge on request to the Bureau at the Central Office.

WOMEN'S AUXILIARY INSTALLS LOUISIANAN AS PRESIDENT

Mrs. C. A. Allenburger of Metairie, La., was installed as president of the Women's Auxiliary to the American Dental Association at its general meeting in New York at the time of the annual session.

Mrs. David S. Fridge, Mobile, Ala., was chosen president-elect and the other new officers are as follows: first vice-president, Mrs. John W. Berk, Reading, Pa.; second vice-president, Mrs. Frederick J. Deneault, Meredith, N. H.; third vice-president, Mrs. H. V. Gieringer, Dayton, Ohio; fourth vice-president, Mrs. H. M. Flickinger, Siloam Springs, Ark.; fifth vice-president, Mrs. Russell B. Petty, Ogden, Utah.

Also, recording secretary, Mrs. F. J.

Reichmann, Oklahoma City, Okla; treasurer, Mrs. G. N. Casto, Jr., Charleston, W. Va.; auditor, Mrs. James V. Gunn, Little Rock, Ark.; and directors, Mrs. John O. Massey, Quitman, Miss., Mrs. M. A. Hoghaug, Grand Forks, N. D., and Mrs. C. N. Ferguson, Prescott, Ariz.

The auxiliary will hold its 1960 meeting at the Ambassador Hotel in Los Angeles October 17-20. Chairman of the local committee on arrangements will be Mrs. John Downing.

NOV. 15 DEADLINE FOR ORDERS FOR OUTDOOR AD POSTERS

November 15 is the deadline for ordering outdoor advertising posters for the 1960 National Children's Dental Health Week, dental societies are reminded by Mr. Perry J. Sandell, director of the Association's Bureau of Dental Health Education.

The posters will be printed after the orders have been received. Orders received after November 15 cannot be filled.

"Start a Lifetime of Smiles" is the theme and slogan of the 24-sheet four-color posters which will highlight the observance of National Children's Dental Health Week February 7-13, 1960.

If the number of posters ordered by all dental societies totals less than 1,000, the price will be $9 each. If the total number ordered is more than 1,000, the price will be $8 each.

Public Health

EXAMS LISTED FOR DENTAL OFFICERS' POSTS IN P.H.S.

Competitive examinations for appointment of dentists as officers in the Regular Corps of the United States Public Health Service Commissioned Corps will be held throughout the United States March 1-4, 1960.

These appointments provide opportunities for career service in clinical dentistry, research and public health. They will be made in the PHS officer grades of assistant dental surgeon and senior assistant dental surgeon, equivalent to Navy ranks of Lieutenant (j.g.) and Lieutenant, respectively. Active duty as a Public Health Service officer fulfills the Selective Service obligation for military duty.

Requirements are U. S. citizenship and graduation from a recognized school of dentistry. Entrance pay for assistant dental surgeon with dependents is $7,345 per year; for senior assistant with dependents, $7,986. Promotions are made at rapid intervals.

Application forms can be obtained by writing to the Surgeon General, United States Public Health Service (P), Washington 25, D. C. Completed applications must be received no later than January 22.

DES MOINES WINS LENGTHY BATTLE TO FLUORIDATE

After eight years of promotion and endeavor on the part of the Iowa State Department of Health and other interested individuals, Des Moines, the capital city, started fluoridation of its public water supply September 1, according to Charles H. Henshaw, state dental director.

In 1954 the City Council requested the Water Board to fluoridate but the board delayed until further study could be made as to the safety of the program. A ruling by the Iowa State Attorney General cleared the way by stating that a city council, by ordinance, could order fluoridation.

On April 14, 1959, the Des Moines City Council, after a 42-page report by the City-County Health Officer, James F. Speers, M.D., passed such an ordinance and the Water Board proceeded with the installation of equipment.

Des Moines' water plant furnishes water to the neighboring towns of Urban-

dale, Windsor Heights, Clive and Pleasant Hill. In the five communities there are approximately 234,000 water users. There are now 34 Iowa communities with a population of 643,238 using fluoridated water.

P.H.S. WILL MAKE DENTAL EXAM PART OF HEALTH SURVEY

A dental examination will be part of the health examination which the Public Health Service United States National Health Survey will give this fall in the Philadelphia area.

As an integral part of the continuing National Health Survey, the purpose of which is to collect data, the project in the eastern Pennsylvania region will be the first to be conducted in some 40 sample areas throughout the country.

Legislation

RULING ON TAX DEDUCTIONS FOR SERVICES FOR CHARITY

According to a recent ruling by the Internal Revenue Service, physicians may deduct as charitable contributions their expenses—but not the value of their services—incurred while performing professional work for charity organizations.

The ruling would appear to be equally applicable to dentists who donate professional services to welfare organizations.

FEDERAL WORKERS HEALTH INSURANCE BILL PASSED

On September 28, President Eisenhower approved legislation authorizing hospitalization and medical care insurance coverage for federal employees. The program becomes effective July 1, 1960.

Under the new law an employee of the federal government may enroll in a health benefit plan approved by the Civil Service Commission, either as an individual or for himself and his family. The government will contribute 50 per cent of the premium but not more than $3.50 per month for an employee who is enrolled for himself alone or $8.50 per month for one who is enrolled for himself and his family.

Under the language of the new law, the inclusion of dental benefits within approved health benefits plans would be permissible. However, because of budget limitations, it is likely that such benefits will be limited primarily to acute medical and surgical procedures involving the oral tissues—so-called oral surgery benefits.

Research

ROCHESTER U. EXPANDS DENTAL RESEARCH, DENTISTRY DEPT.

Formal opening of new and expanded quarters of the department of dentistry and dental research, University of Rochester School of Medicine and Dentistry, took place October 15. Total cost of the project, located on the top floor of the recently completed addition to Wing O at the University of Rochester Medical Center, exceeded $100,000.

The new accommodations provide over 2,000 square feet of space, more than four times the amount formerly occupied. There are six research laboratories, including a $50,000 electron microscope laboratory for studies on dental caries, tooth structure, and salivary glands, and a clinical dental research laboratory which is a fully equipped dental office, according to Dr. Erling Johansen, department chairman.

A new full-time assistant professor of dental research has been added to Dr. Johansen's staff. He is Dimitri A. Afonsky, who received his Ph.D. degree in bacteriology at the UR Medical Center in 1954, and his D.D.S. degree at West

China Union University in 1947. He joined the UR faculty after being in charge of the division of dental medicine at Colgate-Palmolive Company from 1955 to 1959.

HARRY LYONS NAMED TO NEW MEDICAL RESEARCH COMMITTEE

Harry Lyons, dean, School of Dentistry, Medical College of Virginia, and past president of the American Dental Association, has been appointed a member of a new committee to study the impact and effectiveness of United States medical research efforts. Senator Lister Hill (D., Ala.), chairman of the Labor-Health, Education, and Welfare subcommittee of the Senate Committee on Appropriations, announced the organization of a consultant group of eminent scientists and distinguished laymen.

"The health of the American people now and in the future is directly related to the scope and effectiveness of the nation's medical research effort," Senator Hill said. "It is through research that we will find the cause and cure, or better still the prevention, of the major killing and crippling diseases from which millions of our people suffer. We must strengthen and buttress the fine work of private and public agencies in this field and we must appraise the role of the federal government in medical research and the adequacy and effectiveness of its current program."

The newly-formed Committee of Consultants on Medical Research has been instructed to report to the full Committee on or before February 1, 1960.

JAN. 1 DEADLINE TO TRY FOR SCIENCE AWARD FELLOWSHIP

Alan T. Waterman, National Science Foundation Director, has announced that applications are being accepted for Graduate Fellowship awards for advanced study in the sciences. The closing date for the receipt of applications is January 1, 1960. Final selection will be announced March 15.

Fellowships will be awarded in the mathematical, physical, medical, biological and engineering sciences, including anthropology, psychology (excluding clinical psychology), and the following social sciences: geography, mathematical economics, econometrics, demography, information and communication theory, experimental and quantitative sociology and the history and philosophy of science.

In addition to stipends ranging from $1,800 to $2,200, dependency allowances, tuition, laboratory fees, and limited travel allowances will be provided.

Application material for the National Science Foundation Graduate Fellowship program can be obtained from the Fellowship Office, National Academy of Sciences, National Research Council, 2101 Constitution Ave., N.W., Washington 25, D. C.

LOYOLA (CHICAGO) RECEIVES $150,000 RESEARCH GRANT

Loyola University in Chicago has received a federal grant of $150,000 for a five-year program to expand graduate training and research in oral anatomy.

Dr. Harry Sicher, chairman of the anatomy department of the university, has been named director of the program. The funds will be used for graduate student stipends, faculty salaries and equipment.

National Defense

CONVENTION OF MILITARY SURGEONS IN WASHINGTON

The 66th annual convention of the Association of Military Surgeons of the United States will be held November 9-11 at the Mayflower Hotel, Washing-

ton, D. C. Reserve officers will receive retirement point credits for attendance.

The general theme of the conference will be broadening concepts of the practice of military medicine. On Wednesday, November 11, the Dental Section will meet under the chairmanship of Brig. Gen. Leigh C. Fairbank, USA, Ret. John A. Anderson, Chicago, will give a lecture on time and motion studies as related to dental practice.

BRIG. GEN. DALE RIDGELY GETS LEGION OF MERIT; RETIRES

Brig. Gen. Dale B. Ridgely, director of dental activities at Brooke Army Medical Center since December 8, 1956, received the Legion of Merit on his retirement August 31 after 33 years of service as an officer in the Army Dental Corps.

The citation read in part ". . . for exceptionally meritorious conduct in the performance of outstanding services from August 1, 1950 to August 31, 1959."

General Ridgely, a graduate of St. Louis University College of Dentistry, will make his home in San Antonio, Texas. He is a Fellow of the American College of Dentists and of the International College of Dentists.

PEARSON BROWN ASSIGNED TO SURGEON GENERAL'S OFFICE

Col. Pearson W. Brown, DC, recently became assistant chief of the dental division, Army Surgeon General's Office, in Washington, D. C. He will be assistant to Maj. Gen. James M. Epperly.

Colonel Brown succeeds Col. Leland G. Meder, DC, who has been assigned to the U. S. Army Medical Service Combat Development Group at Walter Reed Army Medical Center, Washington, D. C.

Colonel Brown was graduated from Emory University School of Dentistry in 1939. Before coming to his present assignment, Colonel Brown was director of the department of dental science at the Army Medical Service School, Brooke Army Medical Center, Ft. Sam Houston, Texas.

Dental Education

KANSAS CITY U. PLANS NEW DENTAL SCHOOL BUILDING

Launching of a campaign to raise $3,000,000 for a new School of Dentistry Building at the University of Kansas City, means, with its successful completion, that the school will move from its 78 year old downtown location to the university campus. The School of Dentistry is the sixth largest of 48 such institutions in the country.

The Rinehart Memorial Foundation, established to honor Roy James Rinehart, noted dental educator who served as dean of the school from 1928 to 1957, is joint sponsor with the university in the fund and building program.

National chairmen of the campaign are A. F. Schopper and C. D. Owens, dentists of Kansas City, Mo., John M. Clayton, member of the university board of trustees, and Hamilton B. G. Robinson, dean of the dental school.

The new building will house lecture halls, classrooms, laboratories, and clinical and research facilities for approximately 700 students. The problem of space has become critical in the present dental building. The staff is handicapped and student enrollment of necessity has been limited.

DEADLINE NEARS TO SIGN UP FOR HAWAIIAN CRUISE COURSE

The University of Southern California School of Dentistry reminds that November 15 is the deadline for enrolling in its postgraduate study cruise to Hawaii.

The cruise leaves Los Angeles April 4, proceeding by air to Honolulu, and re-

turns to Los Angeles by ship arriving April 18. The course of instruction will include approximately 16 hours aboard ship and a few additional hours in Honolulu at a convenient time. The subjects include restorative dentistry, a new amalgam technic, partial denture diagnosis and design, the reverse pin technic and occlusion.

Enrollment can be made at the division of postgraduate instruction of the school at University Park, Los Angeles 7.

MEMPHIS V.A. HOSPITAL LISTS INTERNSHIP AND RESIDENCY

The Veterans Administration Medical Teaching Group Hospital of Memphis, Tenn., announces that one rotating dental internship and one residency in prosthodontics will be available for the year beginning July 1, 1960.

Information and application forms may be obtained from: Chief, Dental Service, Veterans Administration Medical Teaching Group Hospital, Park Ave. and Getwell St., Memphis 15, Tenn.

VARIETY OF COURSES OFFERED FOR POSTGRADUATE STUDY

Alabama • The University of Alabama School of Dentistry will present two refresher courses during the month of January. William D. Powell, Jr., will conduct a course on clinical and laboratory procedures in crown and bridge January 16-18, and Donald T. Waggoner will instruct a course in oral diagnosis, roentgenographic interpretation, and treatment planning: a correlation with oral pathology, January 22-24.

Further information can be obtained from the director of the refresher course program at the university, 1919 Seventh Ave. S., Birmingham, Ala.

California • The University of California San Francisco Medical Center is offering the following two courses: efficiency in dental practice, by John A. Anderson, November 19 and 20; arrangement of teeth in the artificial denture, by Roland D. Fisher, December 10-12. The address is San Francisco 22.

Emory • Emory University School of Dentistry lists four courses for December and January. They are: high-speed technics, by O. Donald Harvey, and the effect on pulp of high speed, by Charles A. Waldron, both on December 2; endodontics, by James H. Sherard, Jr., Julian L. Kelly and George C. Israel, January 14 and 15; basic technics in labiolingual appliance construction, by Boyd W. T. Tarpley, January 18-20.

Complete details can be obtained by writing to: Dr. Ernest L. Banks, Director of Postgraduate Education, Emory University School of Dentistry, 106 Forrest Ave. N.E., Atlanta 3, Ga.

Indiana • A one-day symposium on partial denture design and construction by Walter Hall, Jr., will be given December 2 at Indiana University School of Dentistry. The department of oral surgery will present a course on dentistry in the hospital December 7-11. A two-day course for dental assistants will be given by members of the faculty February 24 and 25, and the orthodontic department will present a symposium March 9 on interceptive orthodontics.

All sessions will be held in Indiana University School of Dentistry, 1121 W. Michigan St., Indianapolis, with the exception of the symposiums, which will be held in Rice Auditorium, Indiana State Board of Health Building, 1330 W. Michigan St.

Loyola • A course in radiology for the dental assistant will be given November 11 at Loyola University School of Dentistry, Chicago. Instructors are Patrick Toto, Mario Santangelo and Ruth Morris. Fundamentals of the light wire differential forces in the treatment of malocclusions, a postgraduate course for orthodontists, will be presented December 6-12. Faculty will include Joseph R. Jarabak, Gilbert Carter, Walter Winter, Milton Braun and members of the orthodontics staff. The use of gold foil in general practice will be taught February 3 and 4 by Arne F. Romnes, Paul T. Dawson, William P. Schoen and staff. A refresher course on complete dentures will be given February 11-13 by Arthur J. Krol, Thaddeus E. Restarski and Rinert J. Gerhard, and Harry Sicher will conduct a course on the anatomy of the head and neck February 15-17.

Applications and further information can be obtained from the director of the postgraduate division of the school at 1757 W. Harrison St., Chicago 12.

Northwestern • Six February courses are being offered by Northwestern University Dental School. They are: current concepts in operative dentistry applied to daily practice, February 1-3, by Arne F. Romnes, Eugene Bod-

mer, Eugene W. Skinner, Donald W. Palmer and C. M. Stebner; basic oral surgery, February 1-5, by Orion H. Stuteville, Harold L. Harris, M.D., F. Robert Christopher, Eduard G. Friedrich, Benjamin J. Gans, Howard B. Adilman and Donald E. Casey; newer concepts in periodontics, February 1-5, by Max Gratzinger, Dan Y. Burrill, Stanley C. Harris, Ph.D., Irvin T. Harris, Harold T. Perry and Matthew I. Enzer; pedodontics, February 11 and 12, by George W. Teuscher, Norman H. Olsen, Harold K. Addelston, Charles R. Carpenter, Sheldon W. Rosenstein and Judith Wood, M.D.; analysis and treatment of the stomatognathic system for the orthodontist, February 22-24, by John R. Thompson, Harold T. Perry, Frank S. Ryan, Glenn E. Jackson and Sheldon W. Rosenstein; major oral surgery—A, February 29-March 11, by Orion H. Stuteville and Robert B. Shira.

All communications should be addressed to the director of dental postgraduate study at the school. The address is 311 E. Chicago Ave., Chicago 11.

Nebraska • Two courses in the fall and winter are listed by the University of Nebraska. They are: oral surgery for the general practitioner, November 12-14, by Merle L. Hale and W. Wallace Webster; preventive orthodontics for the general practitioner, December 10 and 11, by Sidney I. Kohn and William S. Kramer.

Additional information can be obtained by writing to: John M. Cronland, University Extension Division, The University of Nebraska, Lincoln 8, Neb.

Oregon • The following courses have been scheduled by the University of Oregon Dental School for the winter: ceramics, November 9-13, by John C. Bartels; new concepts, November 16 and 17, by faculty members; orthodontics, November 18-20, by Don H. Carlson; occlusal equilibration, November 30-December 4, by Arne G. Lauritzen; psychological problems, January 18 and 19, by Herman Dickel; pharmacology, January 20, by Elton L. McCawley; dental materials, January 21, by David B. Mahler; head and neck anatomy, January 22, by Ellis B. Jump; occlusal equilibration, February 8 and 9, by Robert L. Platner; esthetic dentures, February 15-19, by Roland D. Fisher.

Further information can be obtained from Vinson M. Weber, Head, Department of Postgraduate Education, University of Oregon Dental School, 611 S. W. Campus Dr., Sam Jackson Park, Portland 1, Ore.

Pennsylvania • The University of Pennsylvania School of Dentistry lists the following six postgraduate courses: hypnosis applied to dentistry, November 30-December 2, by William T. Heron, Ph.D.; the use of ultrasonics in periodontics, December 12, by Henry M. Goldman and D. Walter Cohen; oral diagnosis and roentgenology, January 4-8, by Lester W. Burket and LeRoy M. Ennis; prosthetic relations of the temporomandibular joint, January 18-22, by Ernest R. Granger; hospital dentistry, January 25-27, by John P. Looby; practice administration, March 7 and 8, by Harry M. Klenda.

The school is located at 4001 Spruce St., Philadelphia.

Southern California • The University of Southern California School of Dentistry offers the following postgraduate courses: gold foil class V, November 9, 12 and 19, by Rex Ingraham and staff; cast inlays and single tooth restorations, November 23, by E. D. Shooshan and Russell W. Bassett. Complete information can be obtained from the school at University Park, Los Angeles 7.

Temple • Postgraduate courses offered at Temple University School of Dentistry are: clinical oral pathology, January 14-16, by Max Jacobs; anatomy—head and neck dissection, February 3 to June 8 on Wednesdays only, by Richard M. Snodgrasse, Ph.D.; advanced fixed prosthesis, February 8-13, by George Straussberg; present-day periodontal practice, February 16 through April 26 on Tuesdays only, by Jacoby T. Rothner.

Toronto • A two-day postgraduate course in pedodontics will be presented at the Faculty of Dentistry, University of Toronto, Toronto, Canada, January 11 and 12. The course will be under the general direction of Professor S. A. MacGregor, and emphasis will be given to a discussion of practical methods of preventing malocclusion.

Tufts • Tufts University School of Dental Medicine announces the following refresher courses: crown and bridge prosthesis, January 18-22, by R. Sheldon Stein; cephalographics and diagnosis, January 20-22, by Herbert I. Margolis and staff; oral pathology for the oral surgeon, February 4 through March 31 on Thursdays only, by Irving Glickman, Gerald Shklar and Irving Meyer; orthodontic principles of interest to the general practitioner, February 10 through March 30 on Wednesdays only, Herbert I. Margolis and staff; oral rehabilitation, February 25-27, by Jerome M. Schweitzer; clinical adjustment of the occlusion, March 14-16, by Bernard Jankelson.

Further information can be obtained from

the school's division of graduate and postgraduate studies at 136 Harrison Ave., Boston.

Washington • A review and analysis of dental materials and high-speed rotary instrumentation will be given November 16 and 17 at the University of Washington School of Dentistry by Robert J. Nelsen. Walter A. Wykhuis will conduct a refresher course on removable partial denture prosthesis December 3-5, and a course on the principles of crown and bridge planning and fabrication will be held December 11 and 12 by John D. Guthrie and Kenneth N. Morrison. Further information can be obtained by writing to the department of postgraduate dental education of the school in Seattle.

General

COLLEGE OF DENTISTS HOLDS CONVOCATION, ELECTIONS

A program especially designed to welcome centennial guests from abroad was presented September 13 by the American College of Dentists at its annual convocation. Opportunities and responsibilities in world health services were the themes presented by a panel of distinguished visitors at a day-long session in the Waldorf-Astoria Hotel, New York.

Donald W. Gullett, Toronto, was installed as president of the college. Officers elected to serve for the coming year are: president-elect, Edgar W. Swanson, Chicago; vice-president, Oscar P. Snyder, Columbus, Ohio; treasurer, William N. Hodgkin, Warrenton, Va., and regents to serve for four years: Ralph J. Bowman, New York, and William B. Ryder, Jr., San Francisco.

Honorary fellowships were conferred on Herbert Hoover, Arthur S. Flemming, secretary of Health, Education, and Welfare, who was one of the principal speakers, Charles F. L. Nord, The Netherlands, Thure Brandrup-Wognsen, Sweden, and Albert Joachim, Belgium.

The William J. Gies Awards went to Percy T. Phillips, New York; Gerald D. Timmons, Philadelphia; Harold Hillenbrand, Chicago; Gerald Leatherman, London, England; Lon W. Morrey, Chicago; C. Willard Camalier, Washington, D. C.; Thomas J. Hill, Brecksville, Ohio; Edward B. Spalding, Birmingham, Mich.; C. Carroll Smith, Waterbury, Conn., formerly of Peoria, Ill., and Otto Brandhorst, St. Louis.

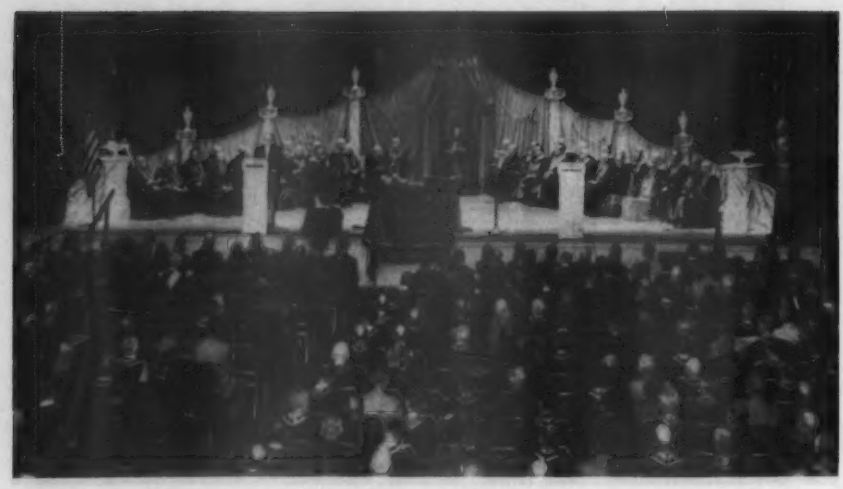
In formal ceremonies at the afternoon session, awards of merit were given to three members of the staff of the American Dental Association whose contributions to the profession of dentistry have been outstanding. They are: Mr. B. Duane Moen, director of the Bureau of Economic Research and Statistics; Mr. John B. Hollister, director of the Bureau of Advertising and Exhibits, and Dr. J. Roy Doty, secretary of the Council on Dental Therapeutics.

BENNO E. LISCHER DIES: WAS NOTED ORTHODONTIST

Benno Edward Lischer, 83, died October 9 at St. Louis. Dean Emeritus of the Washington University School of Dentistry at the time of his death, Dr. Lischer had a long history of outstanding service to the profession.

On his graduation from Washington University in 1900 Dr. Lischer became a member of the faculty and also went into private practice which he later limited to orthodontics. He was a visiting lecturer at the University of Michigan and Columbia University and in 1929 became professor of orthodontics at the University of California. From 1933 to 1945 he was dean of the Washington University School of Dentistry in St. Louis.

Dr. Lischer was a pioneer in the science of orthodontics. He was the author of two books—*Elements of Orthodontia* and *Principles and Methods of Orthodontics*—and contributed many scientific articles and editorials to the dental literature.



Convocation of the American College of Dentists, Sunday, September 13, in the Grand Ballroom of the Waldorf-Astoria Hotel, New York. At the afternoon session 16 men were honored for their significant contributions to the profession.

A scene from the seven act dramatic sketch portraying the "life" of the American Dental Association which was presented at the evening program of the College shows how the Association was started in 1859.

He was past president of the American Society of Orthodontics, the American Association of Dental Editors and the American Association of Dental Schools, among many societies. In 1951 he was awarded the Albert H. Ketcham Award and had received two citations from Washington University. He was a life member of the American Dental Association.

FRED A. HENNY BECOMES ORAL SURGEONS' HEAD

Fred A. Henny, chief of oral surgery, Henry Ford Hospital, and editor of the *Journal of Oral Surgery, Anesthesia and Hospital Dental Service,* was named president of the American Society of Oral Surgeons at the closing session of the society's 41st annual meeting in September in New York.

Dr. Henny was graduated from the University of Michigan School of Dentistry and had his internship and residency in oral surgery at the Henry Ford Hospital. He was an associate in oral surgery from 1938 to 1952 and chief of the division of dentistry and oral surgery from 1952 to the present.

Vice-president of the Michigan State Dental Association, Dr. Henny is also chairman of the section on oral surgery, American Dental Association. He is also a Diplomate of the American Board of Oral Surgery and a Fellow of the American College of Dentists.

Dr. Henny will serve as president of the society through its 42nd annual meeting to be held in Phoenix, Ariz., October 12-15, 1960.

MANILA DENTAL SOCIETY HEAD VISITS CENTRAL OFFICE

Lorenzo G. Almeda, president of the Manila Dental Society in the Philippines, attended the Centennial Session of the American Dental Association in New York, and afterwards visited the Central Office in Chicago to study the structure and workings of the Association before returning to his post in the Veterans Memorial Hospital in Quezon City.

ORAL B COMPANY DONATES $1,500 TO SCIENCE FAIRS

A $1,500 grant to the Association has been made by the Oral B Company, San Jose, Calif., to support reprinting of the booklet "Dental Projects for High School Science Students." The grant also will permit Science Service, which administers the National Science Fair program, to distribute the Association booklet to 12,000 new science fair operators as well as to science teachers.

Last year the Oral B Company contributed $3,000 toward original printing and distribution of the booklet, which promotes dental interest in the science fair program, and 25,000 copies have already been distributed since the first of 1959.

Dental societies can obtain the booklet in lots of 50 for $5 by contacting the Order Department, American Dental Association, 222 E. Superior St., Chicago 11.

FREDERICK F. MOLT DIES; WAS PIONEER ORAL SURGEON

Frederick F. Molt, 78, died October 3 in the Veterans Administration Hospital, Los Angeles, and was buried with full military honors in the National Cemetery in San Diego.

Dr. Molt formerly practiced in Chicago and established the Rosenwald public school dental clinic in 1910. He also served as supervisory dentist in the Chicago Department of Health for many years.

He was a charter member and past president of the Society of Oral Surgeons, was a member of the faculty of the Chicago College of Dental Surgery (now of Loyola University), and was a Fellow of the

This unusual display among the scientific exhibits at the Centennial Session won special mention from the judges. It was sponsored by the American Academy of the History of Dentistry. At the left is Harold L. Faggart, Philadelphia, member of the Academy, and at right is Mr. Robert Meibauer, who died October 11. Mr. Meibauer was the owner of the world's outstanding collection of rare items relating to the history of dentistry, some of which appear in the picture.

International College of Dentists, the New York Academy of Dentistry and the International College of Anesthetists.

During World War 2, he was a captain in the United States Navy, Dental Corps, and after retiring from active duty at the end of the war he resumed private practice in Seattle. In recent years he had made his home in Laguna Beach, Calif.

ARMY MEDICAL MUSEUM SEEKS MATERIAL FOR CENTENNIAL

The Armed Forces Institute of Pathology is seeking military medical material to expand the many famous collections of historical items in its Medical Museum. The museum is dedicated to the collection, preservation, and display of such material and is sponsored by the Army, Navy and Air Force.

The museum houses one of the finest collections of microscopes in the world, but few have been added in recent years. Efforts are now being made to fill the gaps, particularly for the years from 1920 to the present.

The Institute will celebrate its hundredth anniversary during and concurrently with the Civil War Centennial. Museum personnel are now planning the exhibits for this occasion. They are also particularly anxious to receive material of Confederate Army origin, since the collection in this field is meager.

It is requested that persons having items they might wish to contribute write the Director, Armed Forces Institute of Pathology, Washington 25, D. C., relative to the acceptability of items.

MEIBAUER, LAB OPERATOR AND DENTAL ITEM COLLECTOR, DIES

Robert Meibauer, 65, operator of a New York dental laboratory, and owner of an outstanding collection of rare items relating to the history of dentistry, died October 11 at his home in Staten Island.

Some items of Mr. Meibauer's valuable collection were displayed at the Coliseum during the Centennial Session of the Association, in the exhibit of the American Academy of the History of Dentistry which won special mention from the judges of the scientific exhibits.

Mr. Meibauer's son, Robert H. Meibauer, is a practicing dentist in New York, and had an exhibit in the scientific session on subperiosteal implant dentures.

Mr. Meibauer was the first president of the New York State Dental Laboratory Guild, a Fellow of the American Academy of the History of Dentistry, and curator of the Staten Island Historical Museum.

DENTAL ASSISTANTS INSTALL NEW OFFICERS AT NEW YORK

Joy Phillips of Phoenix, Ariz., has been installed as president of the American Dental Assistants Association for 1959-60. She succeeded Elma Troutman, San Francisco.

Other officers named during the group's meeting in New York in September are: president-elect, Lois Kryger, Seattle; first vice-president, Alicia King, Pittsburgh; second vice-president, Ruth Asp, Minneapolis; third vice-president, Alberta Reed, Massillon, Ohio; general secretary, Corinne Dubuc, Pawtucket, R. I.; treasurer, Harriett Darling, Huron, S. D.

Directors of the American Dental Assistants Certification Board are Mrs. Guy Perry, Jacksonville, Fla., Mrs. Thomas Ramsey, Portage, Wis., Madge Tingley, Portland, Ore., and Mrs. Edna Johnson, New Orleans.

Trustees are Olive Steinbeck, Miami, fourth district; Merle Andrews, Huron, S. D., seventh district; Vera Bassett, Salem, Ore., ninth district; Olga Hoover, Waco, Texas, tenth district, and Helen Petersen, Pasadena, Calif., eleventh district.

CAMPBELL, PROMINENT KANSAS CITY DENTAL TEACHER, DIES

Dayton Dunbar Campbell, 77, who with his retirement last February ended 51 years of teaching at the University of Kansas City School of Dentistry, died October 16.

Dr. Campbell was the author of a dental textbook and many articles in dental journals. He was a member of the Pierre Fauchard Academy and a life member of the American Dental Association.

ROWE SMITH FOUNDATION TO HOLD SIXTH ANNUAL SEMINAR

Newer concepts in nutrition will be the theme of the sixth annual seminar of the Rowe Smith Memorial Foundation which will be held December 6-9 at the Fly-N-Fish Lodge on Caddo Lake, Karnack, Texas.

The essayists will be E. Cheraskin, chairman of the department of oral medicine, University of Alabama School of Dentistry, and James S. Dinning, Ph.D., professor and head of the department of biochemistry, University of Arkansas School of Medicine.

SECOND ANNUAL "SUNSHINE SEMINAR" AT MIAMI, JAN. 22-25

Periodontics for the general practitioner will be the theme of the second annual "Sunshine Seminar" sponsored by the Greater Miami Chapter of Alpha Omega fraternity. The meeting will be held January 22-25 at the Deauville Hotel, Miami Beach.

Details of the seminar can be obtained from Dr. Irving Gordon, 420 Lincoln Rd., Miami Beach.

INDONESIAN DENTAL STUDENT IN NEED OF INSTRUMENTS

The Association has received a letter from a dental student in Indonesia who says he is very poor and unable to purchase some of the instruments he needs to continue his clinical work at the school he attends. He is in particular need of a Hanau Articulator and straight and contra-angle handpieces. He would be deeply grateful if some American dentists could help him out.

The name and address are: Lie Fong Lieng, Fakultas Kedokteran Gigi, Universitas Airlangga, Darma Husada 47, Sourabaya, Indonesia.

DENTAL HYGIENISTS ELECT TILLIE GINSBURG

Tillie Ginsburg, Milwaukee, was installed as president of the American Dental Hygienists' Association at its annual meeting in New York.

Other officers elected are: president-elect, Edna Bradbury, Cambridge, Mass.; first vice-president, Ann Ragsdale, Atlanta, Ga.; second vice-president, Mae Sarsfield, Philadelphia, and third vice-president, Margaret Hunt, Fort Wayne.

SET CONFERENCE ON DENTAL ASSISTING FOR JAN. 14-15

Moderators of a conference on dental assisting to be held January 14 and 15 in Washington, D. C., will be Shailer Peterson, secretary of the Association's Council on Dental Education, and Mr. Reginald H. Sullens, secretary-treasurer of the American Association of Dental Schools.

Representatives of the six dental schools which have experience with programs to train dental students in the effective use of auxiliary personnel will report on their three-year findings.

Representatives of other schools starting similar programs this year also will be in attendance, according to Walter J. Pelton, chief, division of dental resources, Public Health Service, whose agency is interested in the project.

RALPH R. BRADSHAW DIES; WAS PRESIDENT OF MINN. SOCIETY

A memorial service was held September 27 in St. Paul, Minn., for Ralph R. Bradshaw, 58, who died September 10.

Dr. Bradshaw, president of the Minneapolis State Dental Association and past president of the St. Paul District Dental Society, was a graduate of the University of Minnesota School of Dentistry.

He had been a delegate for several years to the annual sessions of the American Dental Association and at the time of his death was a member of the Reference Committee on Public Health.

A CORRECTION

In the obituary columns of the September issue of THE JOURNAL, Leonard S. Blumberg of Philadelphia, who died May 8, was erroneously listed as aged 68 and a graduate of the University of Pennsylvania School of Dentistry.

The deceased Dr. Blumberg, who lived at 6810 Loretto Avenue, Philadelphia, was 44 years old and a graduate of Temple University School of Dentistry.

Also • During the academic year 1959-60, Lester W. Burket, dean of University of Pennsylvania School of Dentistry and professor of oral medicine, will give a series of lectures on oral medicine at Jefferson Medical College. . . . Isaac Neuwirth, faculty member of New York University College of Dentistry since 1925, has been named as one of the first three winners of the Great Teacher Awards of the university's Alumni Federation. He received $1,000 with the award. . . . Raymond J. Nagle, dean of New York University College of Dentistry, has been named to the special medical advisory group to the Veterans Administration. . . . John W. Stanford, research associate at the Association's Research Division, National Bureau of Standards, Washington, D. C., has been appointed guest scientist at the Naval Medical Research Institute. . . . Kenneth A. Easlick, professor of dentistry, professor of public health dentistry, and head of the department of dentistry for children at University of Michigan School of Dentistry, has received a Distinguished Faculty Achievement Award presented by the Development Council of the University. The award includes an honorarium of $1,000. . . . Maynard K. Hine, dean, Indiana University School of Dentistry, has been appointed a member of the Board of Regents of the National Library of Medicine for a term expiring in August 1963.

reports of councils and bureaus

American Dental Association statement before the Subcommittee on Problems of the Aged and Aging

COUNCIL ON DENTAL HEALTH
COUNCIL ON LEGISLATION

Although arrival at the age of 65 years may effect a significant change in the economic life of an individual, its occurrence does not automatically bring about a sudden and specific change in his health status. The Council on Dental Health has noted, however, that in programs designed to provide for the social and economic security of any group, there is a trend to include health care as an integral component.

The Council has previously enunciated policy on the role of dentistry in such areas as chronic illness and public assistance.[1,2] It has also developed a set of principles for evaluating programs for the purchase of dental care for any group.[3] It has since noted that there are three basic methods for making health services available to groups: (1) through the dental service corporation, whereby the dental care is provided in the practice of the patient's choice, (2) through insurance plans whereby the subscriber is provided financial support in meeting the costs of his dental care and (3) through the comprehensive health facility which is operated by or for the purchasing group and which uses the services of salaried professional personnel. All the while, the Council has stressed the importance of preventive dentistry, with a life-long program of dental care as the most realistic approach to solving the problems that are now of national concern: the health care of the aged, in which dental care has many ramifications.

The American Dental Association's belief that the total health care of the aged calls for joint effort among all the health professions is reflected in its membership in the Joint Council to Improve the Health Care of the Aged. The other members are the American Hospital Association, the American Medical Association and the

American Nursing Home Association. The Association also urges state dental societies to become active members of state affiliates of the Joint Council.

As Paul Jeserich, president-elect of the Association, stated at the working conference sponsored by the Council in February (1959),[4] "Just as the emotional response to illness gives way in the individual to the demand for the advice of the doctor, so must a group awareness of health problems and their concomitant emotional response give way to the professional appraisal of the problem by the major health professions if the solutions are to be in the best interest of the individual, the community and the high standards of the professional group."

In testimony presented recently before the Subcommittee on Problems of the Aged and Aging of the Senate Committee on Labor and Public Welfare, the Association's philosophy and recommendations regarding the dental care of the aged were summarized. The Council on Dental Health joins the Council on Legislation in urging all state dental societies to bring to the attention of their members the following statement.

1. Council on Dental Health, American Dental Association. The role of dentistry in chronic illness. J.A.D.A. 48:687 June 1954.
2. American Dental Association. Transactions 1958, p. 409.
3. American Dental Association. Transactions 1957, p. 389.
4. Working Conference conducted by the Joint Council to Improve the Health Care of the Aged, February 20 and 21, 1959, at the American Hospital Association, Chicago.

I am Rudolph H. Friedrich of Chicago. I am secretary of the Council on Dental Health of the American Dental Association. The Association has a membership of more than 90,000 and represents about 85 per cent of the nation's dentists. With me is Mr. Bernard J. Conway of Chicago, the secretary of the Association's Council on Legislation. We are here today to discuss the dental health problems of our elderly citizens.

THE AGING PROCESS

In order to focus on the problems of the aged and aging, one must necessarily use the recognized baseline, that is age 65 and older, as defining our elderly population. Although for practical purposes it can be assumed that aging conforms in general with chronology, this assumption should not lead to the conclusion that at a particular age most humans are not fit to continue in productive occupations.

I believe that it is universally accepted by those who treat human ailments that the process of aging does not always follow a consistent chronological pattern. For some persons who reach age 65 the process has advanced to the extent that the physiological characteristics of aging are obvious. For others the aging process is retarded so that these characteristics are negligible. One person of 65 years may look and act like an 80 year old—another like a 50 year old.

To the dental and medical practitioner, age 65 as the dividing line between usefulness and obsolescence for humans is arbitrary and unacceptable. The physician or dentist is especially aware of the individuality of his patients and their physiological and psychological resources. He is also aware, however, of the rapidity with which senescence can develop and advance. Although the dentist or physician may not know exactly how the physiological and psychological quick changes of aging are triggered, he does know that good health, physical and mental, can retard aging significantly. The physician and dentist also know that physiological and psychological changes are many times a series of causes and effects. The loss of teeth, for example, may cause the elderly person to withdraw from activity in society; this in turn can readily bring about actual physical changes, even impairments, which accelerate the aging process.

The oral anatomy is a clear reflector of many disease processes which are prevalent in other organs and areas of the body. It is also subject to local impairments which contribute greatly to the aging process. The nonrestored edentulous mouth, for example, may make a 40 year old person who is so afflicted look 20 years older. If this person, as a result of lack of adequate masticatory function, cannot digest his food properly or cannot partake of essential foods, he may start the cycle of cause and effect that contributes

to the acceleration of the aging process. He will, at the least, have predisposed himself to a more rapid advance toward physiological senescence.

DENTIST'S ROLE IN STEMMING THE AGING PROCESS

The dentist is educated and trained not only to diagnose dental disorders, but also to recognize all anomalies which can be detected either visually, digitally or by x-ray within the oral cavity. He may, for example, be in a position to detect not only the several types of oral malignancies but also the conditions which are precursors to malignancy. The adult who visits his dentist frequently is, in effect, exposing himself to a course of preventive medical treatment that may well prolong his life. (I call your attention to a pamphlet recently published by the American Cancer Society entitled *The Challenge of Oral Cancer*. It describes the importance of the dentist in preventing and detecting oral cancer.)

To illustrate how important a thorough and detailed examination of the oral cavity can be, let us concentrate just on the tongue. The following conditions might be evident: the shiny, smooth appearance in anemias; the increased pigmentation in Addison's disease; the extreme paleness in severe anemias; the cyanosis in heart conditions; the dryness in diabetes mellitus, fevers, and cases of dehydration; canker sores in allergies; ulcerations of acute leukemia; the characteristic lesions in metallic or drug poisoning; the yellow pigmentation most evident along the margins of the tongue in obstructive jaundice; the tremors of paralysis; the scars resulting from bites in epilepsy, and many other manifestations of systemic disease.

The dentist is, of course, educated and trained principally to maintain the health of the human oral anatomy; that is to prevent, treat and cure infections and disorders of the mouth and to preserve the intricate and critical function of the teeth and jaws. Let us look at this latter objective; it is the one most commonly recognized as the dentist's professional objective.

The teeth and jaws must function correctly for many reasons. One of these is to convert our food to a state where it can be swallowed easily and then digested readily. Mastication and digestion of food are dependent on dental function. The importance of the masticatory function, furthermore, increases with age. This is so because the aging process usually reduces the ability of the gastrointestinal system to perform its function. Unless the masticatory operation is kept efficient, then, the result may well be digestive disorders if the person affected tries to consume a normal diet, or nutritional deficiency if that person consumes only soft foods which do not need mastication.

The prevention and treatment of infections and diseases within the oral cavity also directly contribute to preserving the dental function. The periodontal or gum diseases, for example, ordinarily cause the teeth to loosen. This will certainly impair the efficiency of mastication at the point when chewing becomes painful. Unless the infected gums are treated in time, moreover, the dentist will have no choice but to extract the teeth and substitute an artificial restoration. It should be kept in mind that more teeth are lost because of gum diseases than because of cavities in the teeth. It is also significant to realize that the teeth that escape the ravages of dental decay may be lost in late adulthood because of infected gums which are unable to retain those healthy teeth.

It is regrettable that so many people in this country do not heed the best advice the dental profession can offer: "See your dentist regularly and frequently." This is as necessary for those of us who are 50 or 60 as it is for those 20 and 30 years of age. The preservation of the natural dentition not only is of benefit directly to the over-all health of the individual; it also contributes greatly to slowing down the aging process, both physiologically and psychologically. In like manner, for those who lose the natural dentition, the prosthetic replacements which the dentist designs are capable of restoring dental function to an exceptional degree and facial appearance to the same remarkable extent. Again, professional dental care is needed periodically even after complete dentures are inserted. Unless the dentures are checked on a regular schedule as indicated by the dentist, the occurrence of normal changes in the tissues of the mouth may gradually cause loss of proper function and failure of the tissues to support and retain the dentures. For the person who has well-fitting dentures, and who visits his dentist to assure that his dental function is maintained, there will also be a considerable lessening of the aging process, both physiologically and psychologically.

FACILITIES FOR PROVIDING DENTAL CARE TO THE AGING

The American Dental Association believes that dentists in private practice are doing a commendable job in making their services

available to persons over 65 years of age. The critical problem in dental care for the elderly is in caring for those in institutions such as nursing homes and in caring for those who are homebound. The Association recognizes that much needs to be done to make dental care available to these persons. It must also be recognized by all those interested in making dental care available to the elderly that many aged persons will not cooperate and some will actually refuse needed dental care. I would like at this point to portray a recent study of the dental conditions of persons living in 26 nursing homes in Fulton County, Georgia. This study was conducted in 1957 by the Dental Health Service of the Georgia Department of Public Health. It is typical of the excellent projects being launched by some of our state dental health directors. I shall quote at length from this report, entitled "Survey of Dental Conditions in the Nursing Homes in Fulton County."[1]

"In the 26 homes visited, 855 patients were examined. They ranged in age from 23 years to over 99, with 284 male and 571 female. The number of non-ambulatory patients (255) was surprisingly high, which is almost one-third of those in the homes. If those confined to wheel chairs are included, it is safe to estimate that about one-half are non-ambulatory.

"While these patients came from all walks of life, the majority were housewives, farmers, or mechanics. Those individuals with private income, other than welfare or social security, were relatively small. Five hundred and eleven patients indicated they have no other income, 305 had from one to a few dollars per week and a very limited number indicated they were economically secure.

"In only a few instances was a plan mentioned by those in charge of the homes for the routine oral home care such as daily washing and cleaning of dentures, toothbrushing or mouth rinsing. . . ."

"The condition of each tooth was classified in one of eight categories—normal, missing, replaced, filled, decayed, filled and decayed, indicated for extraction due to decay or indicated for extraction due to condition of gums or supporting tissues. For these people, relatively few teeth were found to be normal. Most of their teeth were missing and many had been replaced by dentures. Many of the dentures were too old for use and often extremely unsanitary. It was unusual to find a full upper or lower denture that was not in need of repair or replacement. In fact, it was difficult to understand how many of the patients could use their ill-fitting dentures at all due to looseness, lost teeth, or their own physical or physiolological condition. A considerable number of the older patients had discarded their dentures or had lost them when they were confined to the home or at one of the hospitals when they received treatment. It was evident that dental health of the patients was neglected in most of the homes.

"Due to abnormalities in or around the oral cavity, patients, ambulatory and non-ambulatory, often did not use their dentures. These abnormalities ranged from pathological conditions, flat bridges and closed bite to ill-fitting or broken dentures. As the individual patient progresses in years, in numerous cases an emotional condition develops which sometimes makes it impossible to have any prosthetic appliance in the mouth. Statements were frequently made by patients that 'I can't wear dentures because they worry me.' . . . A number of those patients without dentures are those who would not wear them even if they were provided. These patients have been without dentures for years and stated they would be unwilling to wear them. This fact necessarily would have to be taken into consideration in determining the specific needs in a treatment program. . . .

"Contrary to the usual findings in younger age groups, these old people needed relatively few fillings. The high number of lost teeth, due to extraction, accounts for the small number of teeth in need of fillings. While some fillings are needed, this does not constitute a major problem. Due to loss of so many teeth, the number of fillings present was also small as compared to the younger person outside these institutions.

"The most urgent need was noted in the number of teeth indicated for extraction either due to decay or due to disease of the supporting tissues. The number of oral infections was appalling. Practically all of the patients with natural teeth had some oral pathology ranging in severity from suspicion of cancer to mild gingivitis or gum diseases. . . .

"Of the 289 patients having one or more natural teeth present, periodontal or gum treatment was indicated for 119. Of the few patients with teeth present, 203 teeth need filling, and 1,404 teeth need extracting. Extraction would do more to clear up oral infection for these people than most any other treatment that could be provided. Several cases were designated for oral surgery in preparation for dentures while others were indicated for surgery due to ill-fitting dentures that had been in place for long periods

of time and were causing chronic irritation of mucous tissues.

"The most time consuming and probably the most expensive treatments were the large number of dentures needed, 511 original dentures, and 363 replacement or repair of existing dentures. . . .

"Despite the over-all lack of services, a few of the homes showed an unusual ability to provide adequate services in every respect. Two of the larger homes were equipped with dental clinic facilities and a few of the other homes have arranged with private dentists to provide emergency dental service."

This 1957 survey of dental conditions in the 26 Georgia nursing homes is not intended to typify a normal situation among the elderly. One of the findings, for example, showed that only 18 per cent of the residents had seen a dentist in the last five years. This is somewhat less favorable than has been reported for the general public in similar age groups.

The survey did, however, disclose a need for dental attention among a large group of low-income, institutionalized elderly persons. It discloses also that steps are being taken to find out what are the dental problems of the elderly groups. The fact that this survey was reported in the official publication of the Georgia State Dental Association, accompanied by an editorial promising action by the state's dentists, clearly indicated that state and local groups are ready to cooperate in all reasonable efforts for improving the availability of dental care for the aging.

GOVERNMENT'S ROLE IN PROBLEMS OF DENTAL CARE FOR THE AGED

The federal government has three existing, effective means for cooperating in the improvement of the dental health of our elderly citizens. The first of these is the rapidly expanding research program conducted and supported by the National Institute of Dental Research. Federal grants administered by the Institute now support 40 research projects related to oral health problems of the aged. The Association urges this Committee to recommend additional federal support for dental research projects.

The federal government has, through the dental division of the Public Health Service, furnished leadership and expert advice to our state and local dental public health teams in their effort to identify and evaluate the dental problems of our aged groups. This is the second area for additional federal action. The pilot programs now being carried out in New York City and Kansas City, Missouri, by the Public Health Service in conjunction with the state and local dental societies are excellent examples of appropriate federal leadership. These programs are designed to illustrate modern means for making dental care available to the elderly, including the use of specially designed portable dental equipment to bring care to the institutionalized and, in particular, to the homebound elderly patients.

It is the Association's conviction that the federal government should establish a separate category of grants-in-aid fund, under the Public Health Service Act, earmarked for support of state dental public health activities. The public health programs needed to help assure the availability of dental care to the elderly would be among the several measures that cannot today be initiated in many states because of insufficient funds. The American Dental Association urges this Committee to recommend a federal grant-in-aid authorization under the Public Health Service Act, the funds to be earmarked for support of state dental public health activities.

The third method that the federal government might use more fruitfully in improving dental care for the elderly is the public assistance program. The Association recognizes that federal funds are today earmarked to support state health care programs for the indigent aged. The great need is to stimulate state legislatures and administrative agencies to allocate funds from public assistance grants for dental care. This is a problem which must be solved primarily through dental health information and education programs at the state and local levels. The federal government can help by focusing attention on dental health needs. Again, an appropriate device would be through earmarked funds for state dental public health activities.

In behalf of the American Dental Association, I wish to thank the Committee for the opportunity to testify on this important area of national health concern.

1. Chrietzberg, J. E.; Lewis, Fred D., Jr., and Carroll, J. B. Survey of dental conditions in nursing homes in Fulton County. J. Georgia D.A. 31:15 Jan. 1958.

Additions to the Library

BUREAU OF LIBRARY AND INDEXING SERVICE

The books listed here have been added recently to the Library collection. Requests for this material, available on loan to all members of the Association, should be addressed to the Bureau of Library and Indexing Service. There is no charge for borrowing books, but there is a minimal charge of one dollar for package libraries. Practically all the dental journals published in the world at present are available also to members on loan. Lists of books and package libraries are also available on request.

BOOKS

AMERICAN DENTAL ASSOCIATION. BUREAU OF ECONOMIC RESEARCH AND STATISTICS. Distribution of dentists in the United States by state, region, district and county. Chicago, 1959. 62 p.

AMERICAN DENTAL ASSOCIATION. BUREAU OF ECONOMIC RESEARCH AND STATISTICS. Facts about states for the dentist seeking a location. Chicago, 1959. 34 p.

AMERICAN DENTAL ASSOCIATION. COUNCIL ON DENTAL EDUCATION. Conference on dental specialties and specialization, July 9, 10, 1959; reference manual. Chicago, 1959. 207 p. Mimeo.

AMERICAN PUBLIC HEALTH ASSOCIATION. PROGRAM AREA COMMITTEE ON RADIOLOGICAL HEALTH. Public exposure to ionizing radiations. New York, 1958. 55 p. $1.35.

BONN. UNIVERSITÄT. MEDIZINISCHE FAKULTÄT. Jahrbuch der Dissertationen, 1951-57. Bonn, 1952-58. 7 v. Includes summaries of dental dissertations.

BREDOW, MIRIAM. Handbook for the medical secretary. 4th ed. New York, McGraw-Hill, 1959. 378 p. $4.75.

COOPER, L. F. & OTHERS. Nutrition in health and disease. 13th ed. Philadelphia, Lippincott, 1958. 734 p. $6.

DAVIS, C. A. A survey of the dental needs in state-maintained institutions in New Mexico. Santa Fe, New Mexico Department of Public Health, 1959. 95 p. Mimeo.

DENTISTS' SUPPLY COMPANY OF NEW YORK. A comprehensive dental health care plan for employees and their dependents; underwritten by the Continental Casualty Company. New York, 1959. 21 p.

FISHER, ADELE, comp. Northwestern University Dental School subject heading list. Chicago, Ill., Northwestern Univ. Dental School, 1959. 70 p. $3.

FRANCK, FREDERICK. Days with Albert Schweitzer; a Lambaréné landscape. New York, Holt, 1959. $4.

GERMANY (FEDERAL REPUBLIC). BUNDESVERBAND DER DEUTSCHEN ZAHNÄRZTE. Informationen über zahnärztliche Arzneimittel. 2d ed. Cologne, 1958. 175 p.

GOLDMAN, H. M. & BURKET, L. W. Treatment planning in the practice of dentistry. (Postgraduate dental lecture series.) St. Louis, Mosby, 1959. 305 p. $6.50.

GRAY, HENRY. Anatomy of the human body. 27th ed., edited by Charles Mayo Goss. Philadelphia, Lea & Febiger, 1959. 1458 p. $17.50.

GROSSMAN, L. I. Terapéutica de los conductos radiculares. Traducción y notas Margarita Muruzábal. Buenos Aires, Progrental, 1957. 425 p.

HEATH, JOHN. Serial extraction and mechanically guided development. Melbourne, Verona Press, 1958. 28 p.

HESS, W. C. & MUHLER, J. C. Laboratory manual of biological chemistry for students of dentistry. St. Louis, Mosby, 1959. 118 p. $2.25.

INSTITUTE OF INTERNATIONAL EDUCATION. Open doors 1959; a report on international exchange. New York, 1959. 48 p. $1.

JAY, PHILIP & OTHERS. Dietary program for the control of dental caries. Ann Arbor, Mich., Overbeck, 1959. 28 p. $0.65.

LICHT, W. S. & NEIGHER, H. Tooth or consequences. Boston, Rower Dental Mfg. Co., 1956. 78 p. $1.50.

MORRISON, G. A. & OTHERS. In the dentist's office; a guide for auxiliary dental personnel: hygienist, assistant, secretary. 2d ed. Philadelphia, Lippincott, 1959. 280 p. $7.50.

MUHLER, J. C., ed. Textbook of biochemistry for students of dentistry. St. Louis, Mosby, 1959. 539 p. $12.50.

PHILLIPS, H. M. Safari of discovery; the universe of Albert Schweitzer. New York, Twayne, 1958. 271 p. $4.

RIFFLE, A. B. The mouth; its clinical appraisal. Philadelphia, Lippincott, 1959. 118 p. $3.50.

SCHWARZROCK, L. H. & SCHWARZROCK, S. P. Effective dental assisting. 2d ed. Dubuque, Iowa, Brown, 1959. 563 p. $8.

SONNEDECKER, GLENN; HOCH, J. H. & SCHNEIDER, WOLFGANG. Some pharmacohistorical guidelines to the literature. (Reprinted from *American Journal of Pharmaceutical Education*, Vol. 23, p. 143-172.) Madison, Wis., American Institute of the History of Pharmacy, 1959. 29 p.

STEIGER, A. A. & BOITEL, R. H. Precision work for partial dentures; a technical manual for office and laboratory. Zurich, 1959. 229 p. $16.50.

SWENSON, M. G. Complete dentures. In collaboration with Charles J. Stout. St. Louis, Mosby, 1959. 682 p. $13.50.

U. S. AIR UNIVERSITY. SCHOOL OF AVIATION MEDICINE. Clinical evaluation of devices and technics for the removal of tooth structure, by J. L. Hartley and D. C. Hudson. (Report 58-103.) Randolph AFB, Texas, 1959. 21 p.

U. S. AIR UNIVERSITY. SCHOOL OF AVIATION MEDICINE. A clinical evaluation of the Cavitron portable prophylaxis unit, by C. M. McCall and L. Szmyd. (Report 59-86.) Randolph AFB, Texas, 1959. 12 p.

U. S. AIR UNIVERSITY. SCHOOL OF AVIATION MEDICINE. Human whole saliva volume, sodium, and potassium under prolonged masticatory stimulation, by I. L. Shannon and J. R. Prigmore. (Report 59-63.) Randolph AFB, Texas, 1959. 8 p.

U. S. AIR UNIVERSITY. SCHOOL OF AVIATION MEDICINE. The sodium and potassium concentrations of the saliva commonly found in the floor of the mouth, by I. L. Shannon and J. R. Prigmore. (Report 59-47.) Randolph AFB, Texas, 1959. 4 p.

U. S. AIR UNIVERSITY. SCHOOL OF AVIATION MEDICINE. The sodium and potassium content of the submaxillary glands of pilocarpine-treated Wistar rats, cotton rats, and chinchillas, by I. L. Shannon and R. A. Brooks. (Report 59-65.) Randolph AFB, Texas, 1959. 4 p.

U. S. NAVAL DENTAL SCHOOL (Bethesda, Md.). Endodontics. Prepared under the supervision of Bureau of Medicine and Surgery. Washington, Bureau of Naval Personnel, 1959. 29 p. $0.25.

VYGODCHIKOV, G. V., ed. Pathogenesis and immunology of tumors. Translated from the Russian by R. Crawford. London, New York, Pergamon Press, 1959. 258 p. 80s.

Supplement to the List of Certified Dental Materials

COUNCIL ON DENTAL RESEARCH

DELETION • The American Dental Association Research Division, National Bureau of Standards, has been advised that the manufacturer of the materials listed below is no longer in business. Therefore, their materials should be eliminated from the List of Certified Dental Materials.

CERTIFIED AMALGAM ALLOYS
(A.D.A. SPECIFICATION NO. 1, FIRST REVISION)

Alloy	*Manufacturer or distributor*
Abner Fine Cut; Oxford	Abner Alloys Company

Survey of dentist opinion
IV. Dental magazines

BUREAU OF ECONOMIC RESEARCH AND STATISTICS

One of the purposes of this survey was to measure readership of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION and how it compares with the two other monthly mass circulation dental magazines, *Dental Survey* and *Oral Hygiene*.

For each of these three magazines, the dentist was asked to indicate the number of issues he had read (either briefly or thoroughly) during the preceding 12 months. He was then asked how much time he spent reading each issue, on the average.

The mean (average) number of issues read by Association members during the year was 8.7 for *Dental Survey*, 8.8 for *Oral Hygiene* and 10.2 for THE JOURNAL. The percentage reporting having read all 12 issues was 52.4 for *Dental Survey*, 53.4 for *Oral Hygiene* and 64.2 for THE JOURNAL.

The mean number of minutes spent reading each issue was 37.7 for *Dental Survey*, 37.0 for *Oral Hygiene* and 76.5 for THE JOURNAL. The median was consistent for all age groups and all regions of the country: 30 minutes for *Dental Survey*, 30 minutes for *Oral Hygiene* and 60 minutes for THE JOURNAL.

Multiplying the number of issues read by the number of minutes per issue provides an estimate of the total number of minutes per year spent in reading each magazine by the average member (Tables 30 and 31 and Figures 1 and 2). Annual reading time for *Dental Survey* and for *Oral Hygiene* was almost identical at 328 minutes and 326 minutes, respectively. Annual reading time for THE JOURNAL was 780 minutes, about 2.4 times the figure for the other two magazines. In every age group and in every region of the country THE JOURNAL was read more than twice as long during the year as either of the other two magazines.

Each magazine was read longest by dentists 65 and older. Studies have shown that older dentists have fewer patients; perhaps the increased reading time reflects increased spare time.

Readership figures for *Dental Survey* and *Oral Hygiene* are remarkably similar. The similarity is particularly striking with respect to annual reading time by region (Fig. 2).

Respondents were asked to choose the magazine they preferred with respect to eight different factors (Table 32). THE JOURNAL was the magazine of choice for scientific articles, news of dentistry, amount of advertising read, confidence in advertising, filing of magazines or filing of magazine articles, "favorite" dental magazine and "most beneficial" dental magazine. *Dental Survey* was preferred for articles on practice management, followed by *Oral Hygiene*.

It will be noted in Table 32 that a sizable number of nonmembers indicated preference for THE JOURNAL. Most nonmembers do not receive THE JOURNAL. Apparently many of them either have access to THE JOURNAL or were members of the Association and received THE JOURNAL in their recent past.

In general, the preference for THE JOURNAL was greatest among the younger dentists. As shown in Table 33, the tend-

ency for members to read more advertising in THE JOURNAL than in the other two magazines was definitely stronger among the younger dentists. Table 34 shows that the preference for THE JOURNAL as a magazine to retain in the files was particularly strong among the younger dentists. A similar trend, in some instances less pronounced, prevailed in the answers to most of the other questions in this series.

Replies to the series of eight questions on dental magazine preference were analyzed by type of practice. For each question, the percentage of specialists (as a group) preferring THE JOURNAL was greater than the percentage of general practitioners. For example, 86.4 per cent of the specialists preferred THE JOURNAL for scientific articles, compared to 80.0 per cent of general practitioners; 57.9 per cent of all specialists, and 73.5 per cent of periodontists, compared to 44.3 per cent of general practitioners, preferred THE JOURNAL as a magazine to retain in the files. Among specialists, THE

Table 30 • Readership statistics for a 12-month period for the three mass circulation dental magazines, by age (members)

Age	Dental Survey			Oral Hygiene			J.A.D.A.		
	No. of issues read	Minutes per issue	Total minutes, 12 mos.	No. of issues read	Minutes per issue	Total minutes, 12 mos.	No. of issues read	Minutes per issue	Total minutes, 12 mos.
-29	8.5	36.6	311	7.0	33.4	234	10.3	78.3	806
30-34	8.7	35.2	306	8.4	34.2	287	10.2	73.6	751
35-39	8.7	35.9	312	8.9	35.8	319	10.3	70.4	725
40-44	8.8	37.9	334	9.3	37.0	344	10.2	75.5	770
45-49	8.9	38.0	338	9.1	37.8	344	10.0	76.0	760
50-54	8.8	38.8	341	9.3	38.9	362	10.4	80.1	833
55-59	8.8	41.6	366	9.2	40.1	369	10.3	84.6	871
60-64	8.9	41.5	369	9.5	40.0	380	10.3	80.0	824
65-	8.3	46.8	388	9.5	47.2	448	10.0	98.1	981
All ages	8.7	37.7	328	8.8	37.0	326	10.2	76.5	780

Table 31 • Readership statistics for a 12-month period for the three mass circulation dental magazines, by region (members)

Region	Dental Survey			Oral Hygiene			J.A.D.A.		
	No. of issues read	Minutes per issue	Total minutes, 12 mos.	No. of issues read	Minutes per issue	Total minutes, 12 mos.	No. of issues read	Minutes per issue	Total minutes, 12 mos.
New England	9.3	35.1	326	9.4	34.3	322	10.4	77.5	806
Middle East	8.5	36.5	310	8.9	35.9	320	10.4	77.3	804
South-east	8.8	40.9	360	8.7	39.0	339	10.1	75.4	762
South-west	9.1	40.9	372	8.9	40.2	358	10.4	75.9	789
Central	9.0	38.8	349	9.0	38.4	346	10.1	76.2	770
North-west	9.3	40.1	373	9.3	39.4	366	10.1	73.1	738
Far West	7.9	34.3	271	7.8	33.7	263	10.1	77.0	778
United States	8.7	37.7	328	8.8	37.0	326	10.2	76.5	780

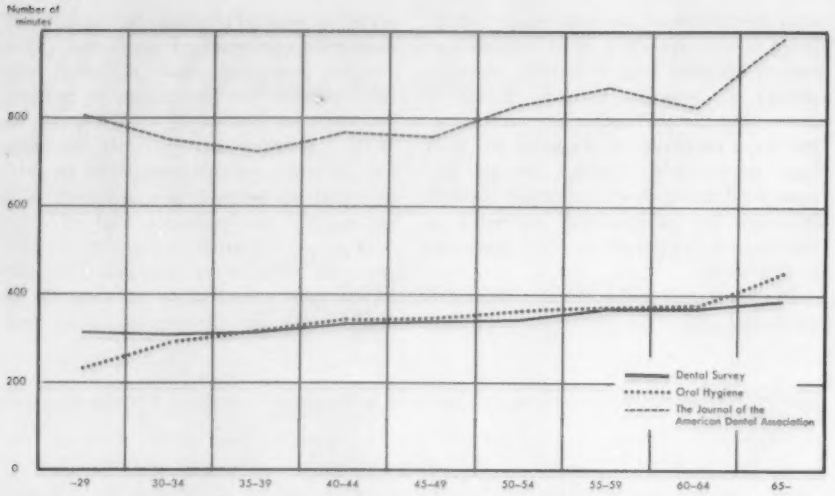


Fig. 1 • Minutes of reading time per member for one year for three dental magazines, by age of dentist

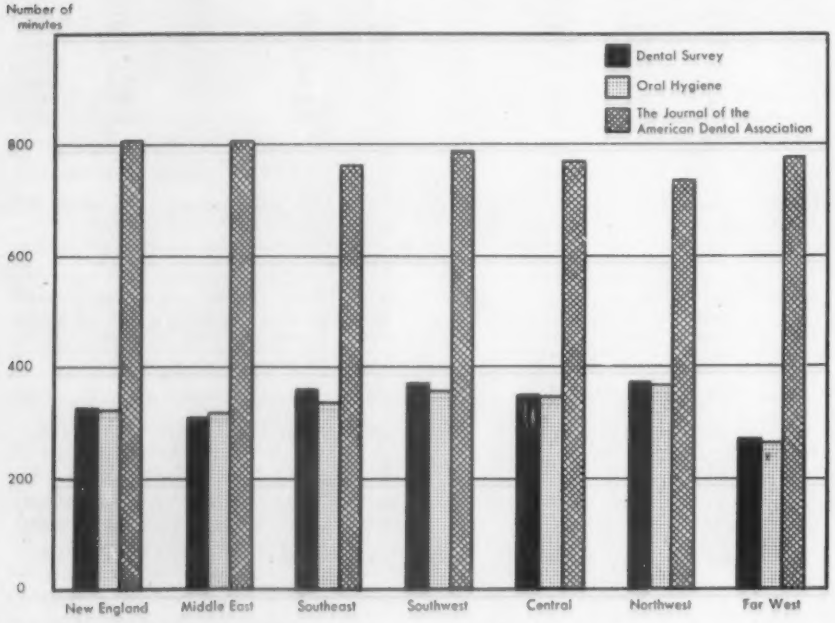


Fig. 2 • Minutes of reading time per member for one year for three dental magazines, by region

Table 32 • Percentage of dentists replying as indicated to questions regarding the three mass circulation dental magazines, by membership status

Question	Dental Survey			Oral Hygiene			J.A.D.A.			No choice expressed			Total		
	Members	Non-members	All dentists	Members	Non-members	All dentists	Members	Non-members	All dentists	Members	Non-members	All dentists	Members	Non-members	All dentists
Which dental magazine do you like best for scientific articles? (Check one)	6.3	19.6	6.8	2.8	14.2	3.2	80.7	31.9	78.8	10.2	34.3	11.2	100.0	100.0	100.0
Which dental magazine do you like best for articles on practice management? (Check one)	29.9	27.0	29.7	24.4	20.1	24.3	17.9	7.8	17.5	27.8	45.1	28.5	100.0	100.0	100.0
Which dental magazine do you like best for news of dentistry? (Check one)	15.0	22.1	15.3	12.1	24.5	12.5	54.2	15.2	52.7	18.7	38.2	19.5	100.0	100.0	100.0
Do you read advertisements in one dental magazine more than in others? If so, which one?	7.0	8.3	7.0	11.4	10.8	11.4	16.2	4.9	15.8	65.4	76.0	65.8	100.0	100.0	100.0
Do you have more confidence in the advertisements in one dental magazine than in others? If so, which one?	.4	3.0	.5	.7	1.5	.7	37.1	12.7	36.2	61.8	82.8	62.6	100.0	100.0	100.0
If you file certain dental magazines, or clip articles for filing, which magazine do you think is most valuable for these purposes?	3.6	7.8	3.7	2.9	6.4	3.0	45.8	17.2	44.7	47.7	68.6	48.6	100.0	100.0	100.0
Everything considered, which is your favorite dental magazine?	9.4	14.2	9.6	9.3	16.2	9.5	58.5	24.0	57.2	22.8	45.6	23.7	100.0	100.0	100.0
Which do you consider to be the most beneficial dental magazine?	5.3	11.3	5.6	4.0	7.8	4.1	67.5	29.4	66.0	23.2	51.5	24.3	100.0	100.0	100.0

Table 33 • Percentage of members replying as indicated to the question "Do you read advertisements in one dental magazine more than in others? If so, which one?", by age

Age	Dental Survey	Oral Hygiene	J.A.D.A.	No choice expressed	Total
-29	10.2	6.0	20.6	63.2	100.0
30-34	8.5	6.9	21.7	62.9	100.0
35-39	7.9	9.7	16.6	65.8	100.0
40-44	6.1	9.9	14.7	69.3	100.0
45-49	7.7	14.5	14.1	63.7	100.0
50-54	6.3	16.2	14.6	62.9	100.0
55-59	4.8	18.2	11.3	65.7	100.0
60-64	4.4	16.2	13.6	65.8	100.0
65-	2.4	17.6	11.4	68.6	100.0
All members	7.0	11.4	16.2	65.4	100.0

Table 34 • Percentage of members replying as indicated to the question "If you file certain dental magazines, or clip articles for filing, which magazine do you think is most valuable for these purposes?", by age

Age	Dental Survey	Oral Hygiene	J.A.D.A.	No choice expressed	Total
-29	6.2	2.4	55.8	35.6	100.0
30-34	4.4	2.9	47.4	45.3	100.0
35-39	2.9	2.7	49.7	44.7	100.0
40-44	4.3	1.8	46.6	47.3	100.0
45-49	2.6	4.1	42.6	50.7	100.0
50-54	2.5	2.5	47.1	47.9	100.0
55-59	3.2	3.5	38.9	54.4	100.0
60-64	3.0	4.1	36.6	56.3	100.0
65-	2.4	2.5	35.5	59.6	100.0
All members	3.6	2.9	45.8	47.7	100.0

Table 35 • Percentage of members replying as indicated to the question "If you read articles in the scientific section of *The Journal of the American Dental Association*, what is your opinion as to the amount of material published on the following subjects?"

Subject	Too much	Amount about right	Too little	No answer	Total
Anesthesia and analgesia	4.7	55.8	24.0	15.5	100.0
Basic sciences	21.6	44.3	17.1	17.0	100.0
Dental economics	4.1	29.4	54.0	12.5	100.0
Dental equipment	5.6	40.4	38.0	16.0	100.0
Operative dentistry	6.9	55.2	22.8	15.1	100.0
Oral surgery	7.9	51.3	24.2	16.6	100.0
Orthodontics	10.7	47.8	22.1	19.4	100.0
Pedodontics	4.1	47.5	29.9	18.5	100.0
Periodontics	9.3	48.2	23.3	19.2	100.0
Practice management	4.6	29.0	53.5	12.9	100.0
Prosthetic dentistry	9.6	53.8	19.2	17.4	100.0
Public health dentistry	20.2	52.1	7.4	20.3	100.0
Roentgenology	5.7	59.0	16.6	18.7	100.0
Therapeutics	2.9	43.4	35.3	18.4	100.0
Practical articles generally	1.5	36.3	49.9	12.3	100.0
Research articles generally	43.4	37.9	6.4	12.3	100.0

JOURNAL held a slight edge over the other two magazines for articles on practice management.

The questionnaire listed topics of scientific articles, and asked dentists to indicate their opinion as to the amount of material appearing in THE JOURNAL on each topic (Table 35). For most topics, a plurality of dentists checked "amount about right." A relatively high percentage of members indicated there was "too little" material in THE JOURNAL on dental economics (54.0 per cent), practice management (53.5 per cent) and practical articles generally (49.9 per cent), and "too much" material on research (43.4 per cent).

There were significant differences in opinions regarding content of THE JOURNAL according to the age of the respondent (Tables 36, 37 and 38). The opinion that there were two few practical articles

Table 36 • Percentage distribution of members who read articles in the scientific section of *The Journal of the American Dental Association* according to opinion regarding the amount of material published on practice management, by age

Age	Too much	Amount about right	Too little	No answer	Total
-29	3.2	30.9	58.4	7.5	100.0
30-34	4.5	29.5	58.3	7.7	100.0
35-39	5.9	27.8	57.6	8.7	100.0
40-44	3.3	28.1	58.0	10.6	100.0
45-49	4.5	26.5	54.1	14.9	100.0
50-54	3.5	27.7	52.7	16.1	100.0
55-59	6.4	31.3	39.8	22.5	100.0
60-64	5.4	32.6	35.8	26.2	100.0
65-	6.2	31.0	32.4	30.4	100.0
All members	4.6	29.0	53.5	12.9	100.0

Table 37 • Percentage distribution of members who read articles in the scientific section of *The Journal of the American Dental Association* according to opinion regarding the amount of practical material published, by age

Age	Too much	Amount about right	Too little	No answer	Total
-29	2.4	37.6	50.6	9.4	100.0
30-34	.9	37.8	54.2	7.1	100.0
35-39	.9	35.4	54.6	9.1	100.0
40-44	1.4	34.0	52.7	11.9	100.0
45-49	1.8	33.6	51.8	12.8	100.0
50-54	1.7	35.2	48.7	14.4	100.0
55-59	2.0	41.0	38.1	18.9	100.0
60-64	3.8	37.4	40.6	18.2	100.0
65-	1.4	37.9	31.0	29.7	100.0
All members	1.5	36.3	49.9	12.3	100.0

Table 38 • Percentage distribution of members who read articles in the scientific section of *The Journal of the American Dental Association* according to opinion regarding the amount of research material published, by age

Age	Too much	Amount about right	Too little	No answer	Total
-29	57.8	30.1	5.4	6.7	100.0
30-34	50.4	38.3	4.2	7.1	100.0
35-39	46.4	37.5	6.1	10.0	100.0
40-44	42.0	37.3	9.4	11.3	100.0
45-49	41.4	39.3	6.5	12.8	100.0
50-54	36.0	39.2	8.9	15.9	100.0
55-59	40.2	37.3	7.2	15.3	100.0
60-64	25.1	46.5	5.4	23.0	100.0
65-	19.3	43.4	7.6	29.7	100.0
All members	43.4	37.9	6.4	12.3	100.0

and too many research articles was expressed by more of the young dentists than of the older dentists. A relatively large percentage of older dentists declined to offer an opinion.

Respondents were asked to indicate how often, and to what extent, they read each of the various sections of THE JOURNAL. Results are shown in Table 39. (Response categories are not mutually exclusive and some dentists checked more than one reply.)

The three "most read" sections of THE JOURNAL were the contents listing on the front cover, summaries of scientific articles and news of dentistry. The three "least read" sections were international correspondence, book reviews and reader comments.

Table 40 presents an index of readership for each topic, by age of dentist. The purpose of the index is merely to enable comparisons between the topics and between the age groups with respect

Table 39 • Percentage of members replying as indicated to the question "If you read *The Journal of the American Dental Association*, how often, and to what extent, do you read each of the parts listed below?"

Part	Usually read all	Usually read some	Occasionally read all	Occasionally read some	No answer
Contents listing on front cover	62.9	14.8	5.9	7.7	8.9
Scientific articles	12.3	46.3	10.7	22.7	10.1
Summaries of scientific articles	32.6	28.9	16.9	12.9	9.1
Editorials	22.7	23.3	11.5	30.8	11.9
International correspondence	7.0	13.8	7.4	47.9	24.1
Current literature	16.4	26.0	11.9	26.3	19.5
News of dentistry	34.9	25.7	12.8	15.7	11.1
Reports of councils and bureaus	19.3	24.0	10.3	29.9	16.8
Reader comments	14.5	20.2	9.9	33.6	21.9
Book reviews	9.5	18.2	8.5	40.3	23.5
Announcements	23.6	20.2	10.4	26.6	19.3
Classified advertising	14.3	22.7	9.3	36.1	17.8
Display advertising	16.2	25.1	9.2	33.1	16.8

Table 40 • An index* of readership of specified parts of *The Journal of the American Dental Association*, by age

Part	Age									All ages
	-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-	
Contents listing on front cover	330	328	327	323	293	308	270	282	253	311
Scientific articles	218	216	221	218	211	218	203	209	196	214
Summaries of scientific articles	263	265	265	266	260	265	222	254	205	258
Editorials	189	192	199	206	222	231	209	255	257	209
International correspondence	126	123	138	135	132	136	106	125	117	129
Current literature	195	186	194	194	188	188	159	193	164	187
News of dentistry	240	243	255	257	264	265	241	264	254	252
Reports of councils and bureaus	179	185	196	192	202	211	193	202	182	193
Reader comments	172	164	168	178	168	170	159	161	166	167
Book reviews	155	141	151	153	147	147	124	140	135	145
Announcements	194	188	206	207	205	208	195	178	193	198
Classified advertising	208	179	178	173	164	169	147	154	147	173
Display advertising	220	195	187	181	170	173	163	169	152	184

*This index was calculated by multiplying percentage of responses by factors as follows, and summing these products: "usually read all" multiplied by 4; "usually read some" by 2.5; "occasionally read all" by 2.5, and "occasionally read some" by 1.

Table 41 • Percentage of members replying as indicated to the question "Does *The Journal of the American Dental Association* in its present form fully meet your needs for a general dental magazine?", by type of practice

Type of practice	Yes	No	No answer	Total
General practitioner	51.4	36.4	12.2	100.0
Specialist	58.6	29.1	12.3	100.0
Oral surgeon	58.7	32.3	9.0	100.0
Orthodontist	60.6	21.2	18.2	100.0
Pedodontist	59.0	33.3	7.7	100.0
Periodontist	55.1	38.8	6.1	100.0
Prosthodontist	63.6	24.2	12.2	100.0
Other	52.2	36.2	11.6	100.0
All types of practice	52.2	35.5	12.3	100.0

Table 42 • Percentage of members replying as indicated to the question "What suggestions, if any, do you have for making *The Journal of the American Dental Association* in its present form more interesting and useful for you?" by type of practice

Reply	General practitioner	All specialists	Oral surgeon	Ortho-dontist	Pedo-dontist	Perio-dontist	Prostho-dontist	Other specialist	All members
Journal content	31.3	20.1	24.5	14.2	23.1	20.4	24.2	22.1	30.0
Place more emphasis on practice management	17.4	8.9	10.3	7.4	9.0	6.1	9.1	11.8	16.4
Articles are too theoretical—too scientific	12.7	5.5	7.1	2.5	7.7	2.0	9.1	8.8	11.8
Make *The Journal* a magazine for the general practitioner	3.3	1.5	1.3	.5	1.2	2.1	6.1	2.9	3.0
Have more articles on clinical procedures	2.6	3.9	3.2	3.9	6.4	6.1	6.1	.0	2.8
Have more reports on new equipment, drugs, materials, etc.	2.3	.3	.6	.0	1.3	.0	.0	.0	2.1
Limit research articles to research journals	.6	1.4	1.9	.5	2.6	2.0	3.0	.0	.7
Include more articles on basic research	.4	1.7	1.9	2.0	.0	4.1	.0	1.5	.6
Other	.8	.9	2.6	.0	.0	.0	.0	1.5	.8
Readability	8.2	4.8	4.4	3.9	6.4	4.1	6.0	5.9	7.8
Articles are too long—too time consuming	5.4	3.1	3.2	2.9	2.6	4.1	3.0	2.9	5.1
Include more illustrations—more photographs —more visual aids—add more color	1.6	1.4	.6	1.0	3.8	.0	3.0	1.5	1.6
Articles are dry—uninteresting	1.2	.3	.6	.0	.0	.0	.0	1.5	1.1
Miscellaneous	4.7	8.5	8.4	4.9	3.9	14.3	9.1	1.5	5.1
No answer	56.7	65.2	62.6	74.5	64.1	59.2	60.6	51.5	57.7

to amount of reading, and no other meaning should be attributed to these figures.

For most of the topics, the index of readership is greater for younger than for older dentists, in spite of the slight tendency, shown in Table 30, for older dentists to spend more time reading THE JOURNAL. The index of readership is definitely higher for younger than for older dentists for summaries of scientific articles, display advertising and classified advertising. The index of readership for editorials is definitely higher for older dentists.

Dentists were asked "Does THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION in its present form fully meet your needs for a general dental magazine?" (Table 41). A little over half (52.2 per cent) of the members replied "yes," about one third (35.5 per cent) checked "no," and the remainder did not answer the question. Among those who answered the question, 60 per cent gave an affirmative answer. Specialists indicated more satisfaction with THE JOURNAL than did general practitioners. It should be noted that wording of the question required unqualified satisfaction with THE JOURNAL for an affirmative answer.

Survey participants were asked to suggest ways by which THE JOURNAL could be made more interesting and useful. An analysis of replies, by type of practice, is presented in Table 42. Thirty per cent of the members made suggestions regarding content, 7.8 per cent commented on readability and 57.7 per cent made no comment. Most of the comments fell into the categories "place more emphasis on practice management" (16.4 per cent) and "articles are too theoretical—too scientific" (11.8 per cent).

The analysis of the Survey of Dentist Opinion will be continued in subsequent editions of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION.

Internal Revenue Service ruling on deductibility of entertainment expenses

COUNCIL ON LEGISLATION

The following is the text of a ruling of the Internal Revenue Service relating to the deductibility of entertainment expenses by physicians. The ruling would apply equally to dentists.

1. A physician may deduct on his Federal income tax return the costs of entertainment, provided he can establish to the satisfaction of the Internal Revenue Service, by appropriate evidence, that such expenses are ordinary and necessary business expenses and clearly related to the production of business income.

2. The amount of the deduction must be proven and its reasonableness determined. Once the amount is established,

the deduction may be claimed when the doctor is able to show that the entertainment had a direct relationship to the conduct of his practice, and can show the business benefit reasonably to be expected from the expenditure. The general statement that he hoped or expected to get referrals or patients as a result of the entertainment is not enough. If personal reasons predominate, the expenditure may not be deducted, even though there is some possibility of a business benefit. Except in the case of industrial physicians, entertainment of individuals who are not doctors will not ordinarily qualify because the possibility of benefits to be expected are so remote as to be negligible. In instances of the entertainment of patients, the same general rules apply as in the entertainment of other doctors, and the clear relationship of the expenditure to reasonably expected income must be shown. The same rules also apply to civic and other club dues.

Criteria to be used in establishing the deductibility of entertainment expenses include, but are not limited to, the following:

a. Specific purpose of the entertainment.

b. Nature of the practice of the doctor incurring the expenditure.

c. Period of time the doctor has been in practice and the number of patients he already has.

d. Percentage of his patients received as referrals.

e. Names of individuals entertained and reason why additional income could reasonably be expected from each.

f. Whether or not referrals were actually received from the doctors entertained and any indication of the effect of the entertainment on these referrals.

g. Number of times individual doctors were entertained during the year, inasmuch as repeated entertainment indicates a personal motive.

h. Whether or not other doctors in the same type practice in the locality have entertainment expenses.

book reviews

MODERN TRENDS IN ANESTHESIA

Edited by Frankis T. Evans and T. Cecil Gray. 318 pages. Index. $15. New York, Paul B. Hoeber, Inc., Medical Book Department, Harper and Bros., 1958.

This is a thought-provoking book for the student of modern medical science and anesthesiology. It is a volume not to be used simply for reference or pleasurable reading, but one to be digested slowly.

The editors acknowledge by the very nature of the material covered that anesthesiology is a new and rapidly expanding field. They have combined the talents of some of the leading names in anesthesiology to provide a fine treatise which covers a wide variety of subjects relating to the practice of anesthesiology. Many of the subjects covered reveal the tremendous advances in the fields of anesthesia and surgery, and demonstrate remarkably well that modern advances in surgery are due in large part to developments in anesthesiology.

The titles of some of the chapters reveal some of the newer trends in anesthesia; for example, "The Relaxant Drugs," "New Conceptions of Consciousness," "Pulmonary Ventilation and Its Control," "Hypothermia," "Cardio-respiratory Pumps," and "Hypnosis." There are also chapters on new drugs; trends in analgesia, sedation, and anesthesia; local and regional anesthesia; surgical trauma and its relation to anesthesia and the circulation; pediatric anesthesia; the autonomic nervous system; the pituitary adrenal system; obstetric analgesia and anesthesia, and research. All these subjects are treated individually. Some chapters are brief and to the point, others oversimplified and, therefore, inadequate; but most are stimulating. As a whole, they combine to provide the reader with an excellent review of a field of medical and dental practice which has emerged and made its presence felt in the scientific world.

Drs. Evans and Gray, by their selection of authors and subject matter, have succeeded in presenting a different type of book on anesthesia which could appeal to scientists in many different fields of theory and practice. The editors have demonstrated more than adequately that anesthesiology is not just another specialty, but a field which is inextricably tied in with advances in many different areas of scientific activity. *Bruce L. Douglas*

ORAL HISTOPATHOLOGY, A MANUAL FOR STUDENTS AND PRACTITIONERS OF DENTISTRY

By Martin A. Rushton, M.A., M.D., Odont. D., F.D.S.R.C.S. Eng. & Edin.; Brian E. D. Cooke, M.R.C.S., L.R.C.P., F.D.S.R.C.S. Eng. 190 pages with 214 illustrations. Index. $7. Edinburgh and London, E. S. Livingstone, Ltd. The (Williams & Wilkins Co., Baltimore, exclusive U. S. agents), 1959.

The authors believed that "it is possible in a small book to show and to relate what is happening at a cellular level in the principal disorders of the teeth and neighboring parts, . . ." They have accomplished their aim in reducing their book to an irreducible minimum in oral histopathology. Over 200 illustrations are included in this closely packed text and are of excellent quality. The book's clarity and simplicity are commendable, but it is too "potted," as some of our English colleagues would describe its brevity.

The text is divided into four parts: I. Teeth and Their Formative Elements. II. The Periodontal Tissues. III. The Oral Mucosa. IV. The Mandible and the Maxilla. In each part developmental anomalies, inflammation, repair, and neoplasms are discussed.

The first part takes up a little more than half of the text with an excellent presentation of dental caries and its sequelae. Discussion of the periodontal tissues includes gingivitis, inflammatory hyperplasia, and a very brief discussion of periodontitis and periodontosis. The oral mucosa is covered in 31 pages, which includes a discussion of developmental anomalies, reactions of the oral mucosa, and neoplasms. The last part, on the jaws, is presented in only 20 pages, and deals with fibrous dysplasia, nonodontogenic cysts, osteomyelitis, healing of fractures and neoplasms.

The book may be characterized as a pocket-size synopsis in dental pathology.

Nicholas G. Grand

DIE SPEICHELDRÜSEN DES MENSCHEN: ANATOMIE, PHYSIOLOGIE UND KLINISCHE PATHOLOGIE (HUMAN SALIVARY GLANDS: ANATOMY, PHYSIOLOGY AND CLINICAL PATHOLOGY)

By Sigurd Rauch, M.D., Ph.D. 507 pages with 227 illustrations. Index. DM. 79. Stuttgart, Georg Thieme, 1959.

Although the author, a Swiss anatomist and medical educator, has approached his subject from the point of view of a physician, the book provides interesting reading and a useful reference for dental practitioners and specialists, especially oral surgeons. The scope of the book is restricted to descriptive and interpretative histology, anatomy, physiology and clinical pathology of the human salivary glands including embryology and therapy. The functions, disturbances and diseases of the salivary glands are discussed with clarity, completeness and with a full consideration of the pertinent international literature.

Among the topics presented are the following of special interest to the dental profession: (1) physiology of the human salivary glands; (2) anatomy, embryology and histology of the parotid, submaxillary and sublingual glands; (3) clinical pathology of the salivary glands; (4) metabolic disturbances of the salivary glands: allergic, hormonal and neurogenetic causes; (5) tumors of the salivary glands; (6) sialolithiasis; (7) anatomic defects and deformities of the glands; (8) diagnosis of diseases of the salivary glands, and (9) treatment of diseases of the salivary glands. Extensive bibliographies accompanying each chapter and a comprehensive index save hours of library research.

It is regrettable that this textbook, written in German, will not have the wide circulation in this country that it deserves. The excellent illustrations and the reference material, however, will be extremely useful for the readers looking for valid information and sound advice in regard to diagnosis and treatment of diseases of the salivary glands. The book must be considered as a fine addition to the literature of the salivary glands. *Paul H. Glucksman*

RESPONSIBILITIES OF STATE DEPARTMENTS OF EDUCATION AND HEALTH FOR SCHOOL HEALTH SERVICES

By the Council of Chief State School Officers. Revised edition. 52 pages. 35 cents. Washington, D. C., Council of Chief State School Officers, 1959.

This is a revised edition of a similar policy statement issued in 1951. The revision committee consisted of seven outstanding public health physicians and educators. It was approved by the Council of Chief State School Officers and the Association of State and Territorial Health Officers, Washington, D. C.

The report is concerned with the school health services that should be provided and how state and local education and health departments can cooperate.

It outlines: the areas where circumstances require that the primary administrative responsibility be vested in educative authorities; other areas of school health services where primary administrative responsibilities must rest with public health authorities, and ways of determining adequate administrative responsibilities of schools and health agencies in the fields lying between these areas.

There are those who would not subscribe to this basic philosophy of administration, particularly on the local level. However, the report is filled with clear, well defined, and practical suggestions and ways for cooperation of all agencies and individuals concerned with child health. *A. O. DeWeese*

HISTORY OF AMERICAN MEDICINE

By Felix Marti-Ibanez, M.D. 181 pages. Index. $4. New York, MD Publications, Inc., 1959.

Many interesting and historically significant incidents of dental and medical practice in the early days of this country are presented in this symposium, published as a paper-covered, six-by-nine inch magazine. The 13 essays come from an illustrious group of contributors who are recognized for their scholarly and professional ability.

As one reads how the healing arts developed as virtually new practices in a new land, one is impressed with the professional eagerness and integrity of its founders. Because of its newness, medical practice in the United States had the good fortune of not being shackled to many outmoded European practices. Certainly, the ingenuity and desire of medicine's founders to explore new horizons is well demonstrated in these essays.

Interesting material is presented regarding medical practices among the American Indians, and there are much valuable data dealing with the development of medical education, the evolution of American medical literature, and the birth and growth of medical societies. Finally, with medical practice well established, we see the introduction of medical research as another important step. There also is useful discussion of progress in public health activities from the colonial period to the present.

Stimulating reading is provided by this contribution, and the essay style makes it a handy volume for consultation when one has a time limit on extracurricular activities.

W. W. Bolton

DIE BIOLOGIE DER KNOCHENGEWEBE: DIE BIOCHEMISCHEN GEWEBSREAKTIONEN DER KNOCHEN NACH DEM DERZEITIGEN STAND DER FORSCHUNG (BIOLOGY OF OSSEOUS TISSUE: BIOCHEMICAL REACTIONS OF BONE TISSUES IN RECENT RESEARCH)

By H. Eggers Lura. 63 pages with 6 illustrations. Index. DM 9.80. Stuttgart, Lege Artis, 1957.

This booklet, the second in a series, *Biologic Research in Dentistry*, differs somewhat in both organization and emphasis from other publications in this field. This is probably because it is intended to be used by dental practitioners and not by dental students. This, however, does not mean that students could not use the book profitably. The fundamental biochemical activity and reactions of the osseous tissue in the maxillofacial region are thoroughly discussed to provide adequate information of biologic, pathologic and physiologic changes observed in recent research studies.

Throughout the text there are appropriate references to a large number of books and monographs, and the booklet includes an extensive author and subject index. Since the language, in general, is nontechnical, this book should be of interest to dentists and may serve as a reference book for researchers in the field of dental biology and biochemistry.

Paul H. Glucksman

QUESTIONS AND ANSWERS IN ANATOMY

By Stanley D. Miroyiannis, Ph.D. 332 pages. $5. New York, Vantage Press, 1959.

Over 500 areas of information concerning the anatomy of the human body are designated by questions and developed in an appropriate series of brief, concise answers. The topics are well chosen and the answers well formulated, yet comprehensive. The arrangement of the topics is at random, with relation to the systems of the body, but a table of contents according to systematic anatomy appears just before the first question. This is believed to strengthen the view that such a book may well be used to check and improve the student's knowledge of the subject, rather than to bypass a more thorough and studious approach to the subject.

The selection of material is excellent and the page arrangement separates adequately the related from the unrelated items. The general form of the book is attractive. The absence of illustrations and diagrams has kept the size and price of the work reasonable and made its contemplation less frightening to the student. Certainly one who has mastered these 501 questions with a mental image of their background, has made great progress toward understanding the structure of the body.

John A. Cameron

A SYNOPSIS OF PHARMACOLOGY WITH SPECIAL APPLICATION TO DENTISTRY

By V. C. Sutherland, Ph.D. 275 pages. Index. $4. Philadelphia, W. B. Saunders Co., 1959.

There may be a need for a small, ready reference book on pharmacology in which the salient principles and facts most important to dentists and dental students are stated clearly. *A Synopsis of Pharmacology* represents a courageous and fairly successful effort to meet such a need.

Coverage of the subject is broad and sufficiently detailed. The material selected is of current interest, it is organized logically and the book is easy to read. The theoretical part is modern. The physiological concepts underlying the action of some of the most important classes of drugs are covered well. A bibliography appears at the end of each chapter.

The book does not compare favorably with the best texts in pharmacology and therapeutics in editorial elegance. Discussions of chemical and physical properties of drugs are not entirely adequate. Typical structural formulas are not always included, even for important classes of drugs.

Although the book is bound in paper, its typography and physical quality are excellent.

In its present stage of development, *A Synopsis of Pharmacology* must be considered experimental. Some teachers of pharmacology may wish to prescribe it to supplement their lectures, and it should be useful to practicing dentists. *Donald A. Wallace*

HIGH SPEED AND ULTRA SPEED IN DENTISTRY EQUIPMENT AND PROCEDURES

By Harold C. Kilpatrick, D.D.S., 289 pages with 429 illustrations. Index. $8.50. Philadelphia, W. B. Saunders Co., 1959.

In the preparation of this text the author has been assisted by 14 contributors and 19 commercial consultants. Thus, this book is not a compilation of a single author's ideology, but it represents the experience and thinking of two groups: one group consisting of practitioners, inventors, and scientists, the other of those engaged in the manufacture of high-speed equipment.

This book contains nearly 300 pages, divided into 18 well-titled chapters, all profusely illustrated. All phases of the subject are adequately covered, and, owing to the fine indexing, any particular information that may be desired is quickly obtainable. All types of high-speed and ultra-speed equipment are well described; the good and bad qualities of each type being pointed out. A complete chapter is devoted to the maintenance of high-speed and ultra-speed equipment. It will be appreciated that both high-speed and ultra-speed equipment are of such nature that unless they receive adequate care and servicing, they will not function satisfactorily. This chapter is sufficiently informative so that the user can do much of the servicing himself, at the time when such service is most important.

It is evident that the author has done an enormous amount of research on this subject. He has prepared his manuscript very carefully and has covered his subject well. All those who are now using high-speed or ultra-speed equipment will profit by a careful reading of this text. Practitioners and dental students who, as yet, have not adopted high-speed technics should, by all means, study this text before purchasing equipment, and in its use, should be guided by the simple and accurate instructions given by Dr. Kilpatrick.

The author expresses himself lucidly. His text is well planned and easy to read. This book deserves a place in the library of every operative dentist. *George M. Hollenback*

THE NATURE OF RETIREMENT

By Elon H. Moore, Ph.D. 202 pages. Index. $4.50. New York, The Macmillan Co., 1959.

For the dentist who has retired or is about to retire, this book offers valuable and sound guideposts for facing retirement, sprinkled with homespun wisdom and insight.

The author, as a scholar and sociologist, bases his study of retirement on detailed questionnaires filled out by over 900 retired people, as well as close consultations with fellow social scientists working in this important field.

This, plus countless interviews, both formal and informal, with retired men and women throughout the United States, assures that *The Nature of Retirement* is as broad in scope as it is thorough and factual in content.

The book includes considerable information about the realities of retirement, including the possible pitfalls, and disappointments and, what may be more important, the reader may obtain an insight and a positive philosophy regarding retirement.

The 20 interesting chapters comprising the book begin with the definition of retirement as the fourth stage of life or in other words the retiree is "one who has relinquished his midlife job or position for a life of greater freedom and leisure."

The author then sets out to write strong, intelligent and logical facts concerning the changing aspects of retirement, including economic preparation. He gives a lucid description of savings, investments, taxes, annuity and insurance provisions along with the problem of reduced status accompanying retirement.

Latter chapters depict the social relationships in retirement, choice of retirement locations, group living for retirees and what communities can do toward provision of social groups and recreational facilities. Almost every page of this staggering amount of printed material bears witness to the author's narrative skill.

For the dentist who contemplates retirement this book is heartily recommended. It is excellent, is based on excellent ideas, and effectively written by a skilled author.

Lloyd H. Dodd

THE DENTIST AND THE SPACE AGE

By William R. Stanmeyer. Mil.Med. 124:417 June 1959.

The submarine and the sealed space ship have in common a condition of prolonged confinement which presents formidable problems of environmental medicine. For the past five years, dental and associated problems of the submarine crew have been under study by the dental profession. For the past three years, dentists have "wintered over" at bases in Antarctica. Information gathered from these two sources may help solve some of the problems of space travel and living.

An 18 month study of the caries rates of men in submarines showed that men living for the most part in a closed environment, as compared with the control group living either on surface crafts or ashore, had an almost 100 per cent increase in cariogenicity as determined by the DMF index. The mean ratios showed an increase in DMF rate of 1.28 in the control group as compared with an increase in DMF rate of 2.46 in the experimental group.

When gingivitis as expressed by the PMA index was studied in the same two groups over the 18 month period, it was found that the mean change in the control group was +1.36 areas; in the experimental group, it was +6.25 areas. If the severity of the inflammatory conditions was recorded, the difference between the two groups was even more significant.

During a recent cruise of an atomic powered submarine, men began to complain of burning of the lips and oral mucous membranes. It was discovered that Freon had been escaping into the vessel from the air conditioning system; Freon breaks down into the gases hydrogen fluoride and hydrogen chloride. Dissolution of these gases in the moisture of the mucous membranes produced strong acids which caused irritation.

The dentists who "wintered over" in Antarctica collected data which eventually may increase our knowledge of man's reaction to the total darkness of outer or inner space. Toothaches due to rapid temperature changes were common, and in most instances were the result of improperly placed fillings or inadequate preparation of teeth prior to arriving in Antarctica. Alveolar osteitis was a problem; lack of postoperative healing occurred in over 22 per cent of extractions in the first year; during the second year of study, men were not allowed to venture into the cold for 24 hours after an extraction; this reduced the incidence of alveolar osteitis to 4 per cent. Bacterial infections seem to cease in cold weather. In personnel exposed to extremely low temperatures, the acid-producing potential of oral bacteria decreases. Diet and dietary supplementation are important factors in maintaining oral health in very cold climates.

Problems yet to be studied include those related to the selection of personnel, to better methods of diagnosis of pulpal and periodontal health, and to tooth restorations which will withstand cold, pressure changes and traumatic stresses.

SOLITARY BONE CYSTS OF THE LOWER JAW IN CHILDREN

By Janina Zemlowa. Czas.stomat. 12:17 Jan. 1959.

The occurrence of solitary bone cysts in the mandible of children is a rare event, and only a small number of case reports have appeared in the literature. In some reports even the accuracy of diagnosis appears doubtful. Some of the authors termed these semi-solid cysts "traumatic" or "traumatic hemorrhagic" cysts.

A nine year old girl was referred to the

dental clinic of the Medical Academy of Warsaw, Poland. She exhibited an enlargement of the lower jaw, especially in the left bicuspid region, causing extreme facial deformity. There was no history of injury and she had no pain.

Roentgenographic examination revealed that the mandible had expanded lingually and bilaterally. There was a rarefied region between the left cuspid and the second molar. The alveolar bone showed a smooth surface, but trabeculation on its inner aspect was evident. All teeth were vital and remained so throughout the treatment.

Initially the cyst resembled a benign giant cell tumor. After preliminary biopsy, which showed no malignant changes, the cavity of the cyst was opened by a submandibular incision. It contained little fluid but some friable dark red substance. The cyst was scraped out and its walls fractured to obtain a more normal contour. Drainage was carried out for two days.

Sections of the cystic lining showed no epithelial tissue but a comparatively thick layer of newly formed connective tissue with a few collagen fibers. Near the wall of the cystic cavity were several osseous or osteoid islands, some of them undergoing a gradual resorption. There were many giant cells, especially in the inner lining, indicating a recent hemorrhage.

Four months after surgery there was no further enlargement of the mandible, and the roentgenograms showed that the cavity was filled with finely trabeculated new bone.

Although the facial appearance was greatly improved it did not look normal. Plastic surgery to reduce the bony prominence was performed 20 months after the first operation.

ANGIONEUROTIC EDEMA AND ALLERGY

By E. Bruun. Allergie & Asthma 4:216 Dec. 1958.

A specific form of localized edema, usually associated with various allergies, is angioneurotic (Quincke's) edema. Patients afflicted with this disorder are prone to exhibit specific patterns of distribution of the edema which mainly involves the lips, tongue, larynx, eyelids, lungs and the extremities. Despite seemingly successful treatment (epinephrine, ephedrine, amphetamine sulfate or antihistamine), the edema frequently recurs after each attack.

During the last two years, 227 patients with angioneurotic edema were observed and treated at the Municipal Hospital of Copenhagen, Denmark. Allergic reactions were determined clinically in 96 patients (42 per cent). In an additional 84 patients (37 per cent), allergic causes were suspected but skin tests, provocation tests and Prausnitz-Küstner reactions were positive only in 47.

Among the demonstrated allergens, drugs and foods (89 per cent) dominated, whereas inhalation and contact allergens (11 per cent) played a comparatively insignificant role.

Among the drugs, salicylic acid, barbituric acid and various antibiotics were the main contributors to allergic reactions. Hypersensitivity to antihistamines occurred only in sporadic instances.

Among the foodstuffs, acid-containing fruits and vegetables were found as being primarily responsible, meat secondarily.

In some instances, exposure to cold and endocrine disturbances during menstruation and climacteric seemed to be the demonstrable factors.

In the majority of instances, patients having an attack of angioneurotic edema came to their dentists because they believed that the symptoms were caused by a tooth infection.

PRINCIPLES AND OBJECTIVES OF THE ARGENTINE ASSOCIATION OF DENTISTS FOR MUTUAL-HELP GROUPS AND HEALTH SERVICES

By Juan C. Gargiulo. Rev.A.odont., Argentina 46:229 July 1958.

The creation of the Association of Dentists for Mutual-Help Groups and Health Services fills a need that previously has not been met by any of the established professional societies in Argentina.

This statement is not intended to degrade the work done by the Federación Odontológica Argentina; it is simply the logical expression of the fact that the persons best able to deal with a problem are those directly affected by it. This was recognized by the subcommittee on group affairs of the Federación as early as 1950 when Antonio Calle Guevara, in his essay "Dental service in mutual-help groups and health service centers," analyzed the problem.

One of the most important aspects of the dentist's participation in such programs is the fact that social services in the field of dentistry are rendered usually at the expense of the dental practitioner. The first step of the new association, therefore, should be the determination of a minimum fee schedule based on the cost of living index. The quan-

tity and quality of the dentist's work, however, also should be taken under consideration, together with the conditions (hours of work required, equipment used, and so forth) under which the dental procedures are performed at the offices or health centers.

Another but less favorable aspect of the problem is the present lack of unity among dentists. If the new association is to be effective and strong, it must have clear and just objectives. It must promote the formation of special commissions or councils which should group the dental practitioners of the entire country not only according to the geographical areas in which they practice but also according to the possible relations to hospital, public health centers, dental schools and clinics. The formation of such commissions and councils will solve the problem of the dental profession separately in each community, thereby making the new association both strong and representative.

At present, the social functions of the mutual-help groups and health services do not meet the requirements of the general public. Argentina has about one dentist taking care of each 2,000 prospective patients; that means if all patients requiring dental care were treated, each individual could expect to receive only one hour of dental care annually.

The need for new dentists can be met only by a thorough reorganization of the dental schools associated with a university along democratic lines, and by the allocation of a far larger share of the national budget to dental education.

The effect of the long-lasting gigantic inflation in Argentine has resulted in an inability of the general public to pay for the dental health care urgently needed. If the impoverishment of the population continues, private dental and medical practice will become a thing of the past.

One possible solution of this problem could be the creation of a national health program. The Association of Dentists for Mutual-Help Groups and Health Services, together with other professional associations and societies as well as practitioners, should analyze the social aspects of public health care from the point of view of the general public and the interest of the profession, and help to formulate a national health insurance program.

If the health problem in Argentina is openly discussed, the interest of all practitioners, governmental authorities and the general public will be aroused. This then will result in logical and immediate action to solve the problem.

AERODONTIA

By Olle Borgh. Odont.Revy. 10:1 Jan. 1959.

The rapid development of aviation has necessitated an extensive specialization in various fields of aviation medicine. Dental problems have appeared, too; the branch of dentistry that deals with these problems is called "aerodontia."

The literature on aerodontia is extensive and describes the effect of flight on teeth and restorations, periodontal diseases among flying personnel, flying and the function of the masticatory apparatus, prosthetic problems during flights, dental problems connected with aircraft accidents, and dental complications after oral surgery.

All these problems have been of special interest in military aviation. As jet-propelled aircraft now are operated in commercial aviation, at extreme altitudes and speeds, it is possible that passengers may be caused dental inconveniences while flying.

The bibliography lists 65 references in international dental literature.

THROMBOANGIITIS OBLITERANS

J.A.M.A. 170:256 May 9, 1959.

Q.—Are there any detectable signs in the oral mucosa which might hint at latent thromboangiitis obliterans? Are these signs influenced by recent smoking?

A.—There are no vascular lesions in the oral mucosa suggestive of thromboangiitis obliterans. It is true that this disease may occur in many visceral vessels, including cardiac, renal and cerebral arteries. Although many systemic disorders have characteristic signs in the oral cavity, thromboangiitis obliterans is not one of them.

deaths

Bruemmer, Miles R., Beloit, Wis., Marquette University Dental School, 1926; died May 17; age 57.

Brusse, Archie B., Denver; University of Denver School of Dentistry, 1912; died May 31.

Burton, Delbert C., Salem, Ore.; North Pacific College of Oregon School of Dentistry, 1912; died May 24; age 69.

Busch, Carl C., Champaign, Ill.; Indiana Dental College, 1923; died June 22; age 79.

Bush, Curtis C., Saginaw, Mich.; University of Iowa College of Dentistry, 1927; died June 2; age 75.

Butler, Horace W., Akron, Ohio; Ohio College of Dental Surgery, University of Cincinnati, 1915; died June 25; age 69.

Dippel, Frederick C., Baraboo, Wis.; University of Illinois College of Dentistry, 1919; died June 22; age 61.

Donovan, Gregory P., Aberdeen, S. D.; University of Minnesota School of Dentistry, 1935; died April 27; age 50.

Dorset, Stuart W., Laurel, Md.; Baltimore College of Dental Surgery, University of Maryland, 1922; died May 20; age 63.

Douglas, Bert B., Dallas, Texas; Baylor University College of Dentistry, 1925; died May 30; age 63.

Doyle, John, Traverse City, Mich.; University of Michigan School of Dentistry, 1944; died May 24; age 50.

Dunlevy, Homer E., Indianapolis; Louisville College of Dentistry, 1915; died May 25; age 68.

Eldred, Bert E., Olympia, Wash.; North Pacific College of Oregon School of Dentistry, 1945; died June 4; age 44.

Erwin, James E., Howell, Mich.; University of Michigan School of Dentistry, 1908; died June 6; age 74.

Ford, Walter B., Salina, Kan.; Western Dental College, 1910; died June 24; age 71.

Hannaway, Edward L., Manchester, N. H.; Creighton University School of Dentistry, 1942; died June 21; age 44.

Hansen, Fred W., San Francisco; College of Physicians and Surgeons, 1927; died June 25; age 54.

Hansen, Harold O., Oak Park, Ill.; University of Illinois College of Dentistry, 1915; died June 28; age 68.

Hare, David A., Oak Park, Ill.; Chicago College of Dental Surgery, 1894; died July 23; age 85.

Hektner, Hans C., Fergus Falls, Minn.; University of Minnesota School of Dentistry, 1903; died April 7; age 83.

Hennebery, Marcus M., Tucson, Ariz.; Baltimore College of Dental Surgery, University of Maryland, 1916; died June 29; age 72.

Herndon, Adolph K., Kansas City, Mo.; Kansas City-Western Dental College, 1926; died May 26; age 57.

Hirsch, Leon, Bridgeport, Conn.; Temple University School of Dentistry, 1905; died February 20; age 75.

Hoffman, John B., Pitcairn, Pa.; Pennsylvania College of Dental Surgery, 1895; died February 19; age 86.

Hoffman, Robert K., Grand Rapids, Mich.; University of Michigan School of Dentistry, 1911; died June 16; age 75.

Hoopman, Earle N., Columbus, Ohio; Starling-Ohio Medical College Department of Dentistry, 1914; died June 1; age 68.

Horen, Edward B., Washington, D. C.; National University Dental Department, 1901; died May 11; age 88.

Howard, Ralph A., Everett, Pa.; Temple University School of Dentistry, 1920; died June 14; age 63.

Hughes, John E., Clarendon, Ark.; University of West Tennessee Dental Department; died May 4.

Humphrey, William T., Cordova, Ill.; Northwestern University Dental School, 1900; died June 11; age 81.

Husler, David P., Carnegie, Pa.; Pittsburgh Dental College Western University of Pennsylvania, 1907; died March 5; age 78.

Hutton, Hubert M., Kansas City, Mo.; Western Dental College, 1900; died June 20; age 82.

Iles, Walter L., Seaview, Wash.; North Pacific College of Oregon School of Dentistry, 1917; died June 11; age 65.

Jaquette, Charles H., Youngwood, Pa.; University of Pittsburgh School of Dentistry, 1954; died May 24; age 33.

Jeter, Jay P., Chester, Pa.; University of Pennsylvania School of Dentistry, 1918; died May 12; age 65.

Johnson, Ernest S., Waterville, Minn.; University of Minnesota School of Dentistry, 1912; died May 27; age 69.

Jones, Wilkinson B., Riverside, Calif.; University of Southern California School of Dentistry, 1928; died June 1; age 58.

Kahn, Morton, Brooklyn; New York University College of Dentistry, 1933; died May 13; age 48.

Karian, Hovane H., St. Louis; Washington University School of Dentistry, 1912; died May 21; age 84.

Keeble, Leon, Elgin, Texas; Texas Dental College, 1916; died June 20; age 65.

Kelley, Nathan H., Salida, Colo.; University of Iowa College of Dentistry, 1898; died June 29; age 87.

Knoche, Karl G., Jacksonville, Fla.; University of Minnesota College of Dentistry, 1908; died March 21; age 72.

Koch, William H., Milwaukee; Marquette University Dental School, 1921; died May 18; age 61.

Kozlow, Herman E., River Rouge, Mich.; University of Michigan School of Dentistry, 1925; died June 13; age 56.

Kramer, Philip, Bronx, N. Y.; New York College of Dentistry, 1923; died May 5; age 61.

Krause, Leland L., Milwaukee; Marquette University Dental School, 1936; died May 27; age 50.

Latimer, Milo B., Corning, Iowa; Creighton University School of Dentistry, 1909; died April 27; age 77.

Leichter, Reuben R., Mission, Kan.; Western Dental College, 1916; died May 18; age 80.

Lentine, Frank R., Boston; died June 3; age 78.

LeVan, Carl E., Altoona, Pa.; University of Pennsylvania School of Dentistry, 1913; died June 14; age 76.

Libby, George W., Burlington, Vt.; died June 3; age 90.

Lloyd, Z. Bernard, Washington, D. C.; Georgetown University School of Dentistry, 1938; died May 22; age 45.

Loft, William C., Cottonwood, Idaho; died June 11; age 75.

Losee, Irving H., Albany, N. Y.; Philadelphia Dental College, 1891; died June 9; age 89.

Lyon, David E., Jefferson, Iowa; University of Iowa College of Dentistry, 1908; died February 20; age 73.

Lyon, Ollie M., Sarasota, Fla.; Louisville College of Dentistry, 1917; died June 6; age 67.

MacDougall, Alex, Portland, Ore.; North Pacific College of Oregon School of Dentistry, 1905; died July 9; age 91.

MacLean, Robert, New York; University of Pennsylvania School of Dentistry, 1918; died May 30; age 63.

Manning, Charles H., Newmarket, N. H.; Baltimore College of Dental Surgery, University of Maryland, 1911; died June 2; age 71.

Marks, Benton I., Mt. Clemens, Mich.; University of Michigan School of Dentistry, 1924; died July 3; age 60.

Martin, Warren F., Niles, Mich.; University of Michigan School of Dentistry, 1924; died April 30; age 62.

Mason, Rodney J., New Rochelle, N. Y.; New York University College of Dentistry, 1932; died June 7; age 52.

Mathews, Donald M., Yuba City, Calif.; University of California College of Dentistry, 1951; died May 15; age 36.

Maurer, Carl A., Kiel, Wis.; Marquette University Dental School, 1918; died June 19; age 63.

McCreery, Robert F., Wahoo, Neb.; Western Dental College, 1898; died April 15; age 81.

McDonald, Ellery A., Petoskey, Mich.; Northwestern University Dental School, 1909; died June 26; age 77.

McMullen, Charles A., Baltimore; Baltimore College of Dental Surgery, University of Maryland, 1927; died July 3; age 59.

Mertes, Edward E., Chicago; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1934; died April 27; age 48.

Middick, Ruel E., New Orleans; State Dental College, 1917; died May 26; age 64.

Miller, Walter E., Denver; University of Denver School of Dentistry, 1910; died June 23; age 71.

Milne, Stuart M., Seattle; Philadelphia Dental College, 1897; died April 10; age 85.

Mindlin, Barnett, Chicago; Northwestern University Dental School, 1911; died June 30; age 75.

Mitchell, Ferman R., Winnetka, Ill.; Northwestern University Dental School, 1929; died June 4; age 58.

Mitziga, Daniel W., Chicago; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1951; died June 25; age 36.

Molseed, Adrian J., Orfordville, Wis.; Marquette University Dental School, 1922; died May 27; age 58.

Moore, Elmer, Lubbock, Texas; Texas Dental College, 1930; died May 8; age 60.

Morgart, Theodore O., Pittsburgh; University of Pittsburgh School of Dentistry, 1926; died July 5; age 57.

Morgenstern, Harry, Brooklyn; New York College of Dentistry, 1919; died May 31; age 63.

Morris, Walter H., Sea Cliff, N. Y.; New York Dental School, 1902; died January 1; age 79.

Moses, Charles, New Kensington, Pa.; University of Pennsylvania School of Dentistry, 1915; died January 31; age 64.

Moylan, Francis J., Scranton, Pa.; Temple University School of Dentistry, 1923; died June 10; age 64.

Nelson, Melvin O., Sioux Falls, S. D.; Chicago College of Dental Surgery, 1917; died May 7; age 65.

Newmyer, John W., Irwin, Pa.; University of Pittsburgh School of Dentistry, 1903; died May 30; age 78.

Nida, Braden E., Marietta, Ohio; Ohio State University College of Dentistry, 1923; died July 5; age 62.

Niebergall, Gerald M., Hackensack, N. J.; Baltimore College of Dental Surgery, University of Maryland, 1936; died May 25; age 47.

Niles, Edith C., Manchester, N. H.; died April 3; age 68.

Noel, Paul M., Klamath Falls, Oregon; North Pacific College of Oregon School of Dentistry, 1918; died June 8; age 62.

Nolan, John L., Brooklyn; College of Dental and Oral Surgery, 1920; died June 14; age 76.

Paget, Josiah H., El Paso, Texas; University of Maryland Dental Department, 1900; died May 18; age 83.

Paikowsky, Hyman L., Fairfield, Maine; Baltimore College of Dental Surgery, University of Maryland, 1925; died May 31; age 62.

Parr, John C., Collierville, Tenn.; University of Tennessee College of Dentistry, 1899; died May 27; age 76.

Patton, Ben C., Murfreesboro, Tenn.; Tulane University School of Dentistry, 1921; died June 16; age 58.

Pendery, Harry H., Fort Worth, Texas; Baylor University College of Dentistry, 1927; died February 13; age 55.

Penney, Clyde L., Rangeley, Maine; Louisville College of Dentistry, 1917; died June 18; age 71.

Pierce, John P., Oakland, Calif.; College of Physicians and Surgeons, 1930; died June 28; age 68.

Pomrening, Herman E., Clintonville, Wis.; Marquette University Dental School, 1904; died January 7; age 84.

Pound, Eugene H., Jacksonville, Fla.; Southern Dental College, 1903; died June 8; age 77.

Powers, Freeman T., New Milford, Pa.; Temple University School of Dentistry, 1907; died June 9; age 82.

Pye, J. Frederick, Bellerose, N. Y.; College of Dental and Oral Surgery, 1910; died June 1; age 78.

Rabensteiner, Albert C., New Orleans; Washington University School of Dentistry, 1908; died May 16; age 73.

Reichner, Charles, Brooklyn; New York University College of Dentistry, 1926; died June 1; age 59.

Riley, E. Bayles, Moberly, Mo.; Western Dental College, 1919; died June 5; age 61.

Roberts, Alfred P., Roselle Park, N. J.; Pennsylvania College of Dental Surgery, 1887; died June 13; age 90.

Robinson, Arthur L., Hamlet, N. C.; Meharry Medical College School of Dentistry, 1917; died April 11; age 70.

Rooks, Walter M., Syracuse, N. Y.; University of Buffalo School of Dentistry, 1905; died June 14; age 76.

Roosa, Earle J., New York; University of Pennsylvania School of Dentistry, 1906; died May 2.

Rose, Fred W., Moorhead, Minn.; Chicago College of Dental Surgery, 1896; died June 30; age 84.

Rose, Sidney A., Milwaukee; Marquette University Dental School, 1922; died June 21; age 61.

Rothenberg, Irving, Chicago; Loyola University School of Dentistry, Chicago College of Dental Surgery, 1924; died June 20; age 58.

Rowley, Lloyd E., Clovis, N. Mex.; Kansas City Dental College, 1904; died May 22; age 78.

Rubright, Mervin M., North Canton, Ohio; Ohio Medical University College of Dentistry, 1901; died June 10; age 79.

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announcements

MEETINGS OF THE AMERICAN DENTAL ASSOCIATION

One-Hundred and First Annual Session	October 17-20, 1960	Los Angeles
One-Hundred and Second Annual Session	October 16-19, 1961	Philadelphia
One-Hundred and Third Annual Session	October 29-November 1, 1962	Miami Beach, Fla.
One-Hundred and Fourth Annual Session	October 14-17, 1963	Atlantic City, N.J.

MEETINGS OF CONSTITUENT SOCIETIES

State	*Date*	*Place*	*Secretary and Address*
Alabama	Apr. 21-23	Birmingham	C. R. Crook, Professional Center, Montgomery
Alaska	July 5-7	Juneau	W. E. Alexander, 406 G St., Anchorage
Arizona	Apr. 13-15	Tucson	W. G. Burke, 15 E. Monroe St., Phoenix
Arkansas	Apr. 3-6	Little Rock	D. M. Hamm, Box 89, Clarksville
California	Apr. 25-27	San Francisco	W. J. Healy, 518 Sutter St., San Francisco 8
S. California	May 2-4	Los Angeles	J. H. Thomason, 903 Crenshaw Blvd., Los Angeles 19
Colorado			G. H. Siersma, 724 Republic Bldg., Denver 2
Connecticut	May 18, 19	Hartford	E. S. Arnold, 37 Linnard Rd., W. Hartford
Delaware			E. J. Truono, 1401 Gilpin Ave., Wilmington 6
Dist. of Columbia	Mar. 13-16	Washington	J. F. Keaveny, 1835 Eye St., N.W., Washington 6
Florida	May 15-18	Miami Beach	R. Chace, 518 Tampa St., Tampa
Georgia			F. M. Butler, Jr., 701 Southern United Bldg., Macon
Hawaii	Oct. 24-27	Honolulu	J. H. Dawe, 810 N. Vineyard St., Honolulu
Idaho	Sept. 15-17	Sun Valley	H. E. Burgess, 151 Fourth Ave., N., Twin Falls
Illinois	May 11-13	Rockford	P. W. Clopper, 632 Jefferson Bldg., Peoria
Indiana	May 16-18	Indianapolis	C. L. Howell, 1012 Hume Mansur Bldg., Indianapolis 4
Iowa	May 2-4	Des Moines	H. N. Hake, 639 Insurance Exchange Bldg., Des Moines
Kansas	May 1-4	Wichita	F. A. Richmond, Brotherhood Bldg., Kansas City 1
Kentucky	Mar. 31-Apr. 2	Lexington	A. B. Coxwell, Jr., 2208 Dundee Rd., Louisville 5
Louisiana	Apr. 27-30	New Orleans	J. S. Bernhard, 231 Atkins Ave., Shreveport 26
Maine	June 16-18	Rockland	S. M. Gower, 6 Coburn Ave., Skowhegan
Maryland	June 8-12	Atlantic City	W. Schunick, 19 Medical Arts Bldg., Baltimore 1
Massachusetts	May 1-4	Boston	H. E. Tingley, 227 Commonwealth Ave., Boston
Michigan	May 2-4	Detroit	F. Wertheimer, Michigan Dept. of Health, Lansing
Minnesota	Apr. 25-27	St. Paul	C. V. E. Cassel, 2236 Marshall Ave., St. Paul 4W
Mississippi	Apr. 24-27	Jackson	M. C. O'Keefe, Medical Arts Bldg., Jackson 2

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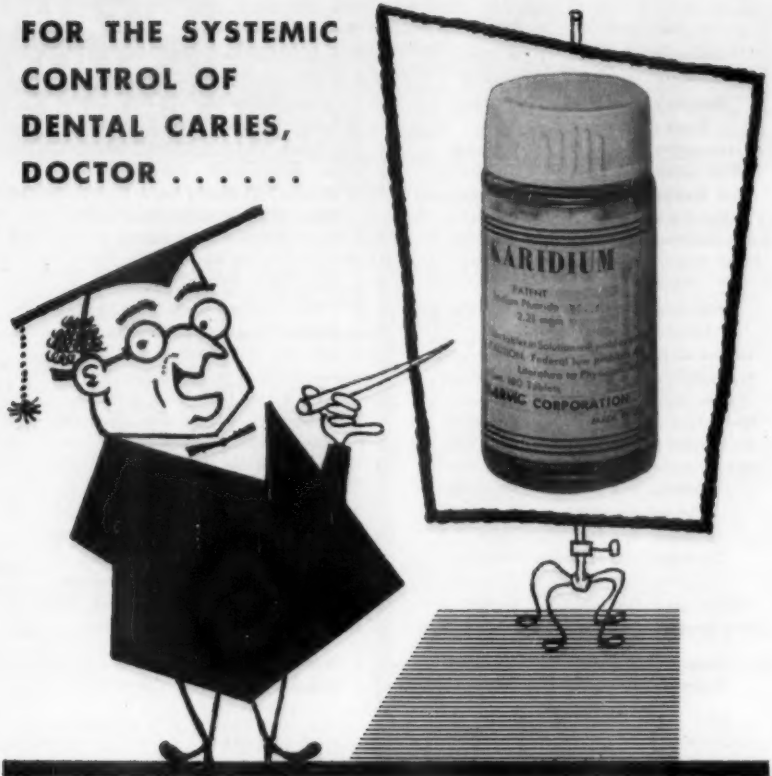

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Literature on request.

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State	*Date*	*Place*	*Secretary and Address*
Missouri	May 22-25	St. Louis	E. D. Suggett, Merchants Bank Bldg., Jefferson City
Montana	May 5-7	Missoula	R. C. Ritter, 1236 N. 28th St., Billings
Nebraska	April 25-27	Omaha	F. A. Pierson, Federal Securities Bldg., Lincoln
Nevada	June	Elko	O. M. Seifert, 755 Ryland Ave., Reno
New Hampshire	June 12-15	Whitefield	F. E. Williams, 814 Elm St., Manchester
New Jersey	Apr. 25-28	Atlantic City	J. G. Carr, 407 Cooper St., Camden
New Mexico	May 15-18	Albuquerque	W. A. Blueher, 2917 Santa Cruz, S. E., Albuquerque
New York	May 9-11	Buffalo	C. A. Wilkie, 268 Ashland Pl., Brooklyn 17
North Carolina	May 1-4	Pinehurst	S. B. Towler, P.O. Box 11065, Raleigh
North Dakota	Sept. 11-13	Williston	D. R. Perry, Box 866, Bismarck
Ohio			E. G. Jones, 185 E. State St., Columbus
Oklahoma	Apr. 24-27	Oklahoma City	L. D. Wright, 210 Plaza Court Bldg., Oklahoma City
Oregon	Mar. 7-9		T. D. Holder, Selling Bldg., Portland
Panama C. Z.			G. E. Lilly, Box 29, Ft. Clayton
Pennsylvania	May 12-14	Harrisburg	I. Sissman, 217 State St., Harrisburg
Puerto Rico	Jan. 24-27	San Juan	R. Gonzalez R., Box 10452, Caparra Heights
Rhode Island	Jan. 19, 20	Providence	C. A. Spacagna, Union Trust Bldg., Providence
South Carolina	May 8-10	Greenville	J. E. Wallace, 1506 Gregg St., Columbia
South Dakota	May 15-17	Sioux Falls	R. E. Decker, Box 308, Parker
Tennessee	May 1-5	Memphis	K. P. Ezell, 119 Louise Ave., Nashville 5
Texas	Apr. 24-27	Fort Worth	C. A. McMurray, 3707 Gaston Ave., Dallas 10
Utah	Apr. 14-16	Ogden	R. C. Dalgleish, 1554 Princeton Ave., Salt Lake City
Vermont	June 24-26	Vergennes	E. C. Woods, 128 Merchants Row, Rutland
Virginia	Apr. 24-27	Richmond	M. E. Henderson, Shenandoah Bldg., Roanoke
Washington	Mar. 20-23	Seattle	G. D. Dore, Jr., 211 Medical Dental Bldg., Seattle 1
West Virginia	July 17-20	White Sulphur Springs	G. N. Casto, Jr., 710½ Lee St., Charleston
Wisconsin	May 9-11	Milwaukee	C. J. Baumann, Jr., 704 W. Wisconsin Ave., Milwaukee
Wyoming	June	Jackson	T. J. Drew, State Office Bldg., Cheyenne

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

State	*Date*	*Place*	*Secretary and Address*
Alabama	June 19-25* June 20†	Birmingham	W. L. Smith, 524 Chestnut St., Gadsden
Alaska	July 5-8	Anchorage	E. I. Baggen, Box 1394, Fairbanks
Arizona	June 19-30	Florence	W. G. Biddulph, 1611 N. Second Ave., Glendale
Arkansas	June 20-25*†	Little Rock	G. Cone, 113 S. Pecan St., Osceola
California			J. F. Steen, 507 Polk St., San Francisco
Colorado	June 19-25	Denver	B. DeRose, Republic Bldg., Denver 2
Connecticut			A. P. Delfini, 265 Church St., New Haven
Delaware			J. F. Maguire, 1200 N. Van Buren St., Wilmington
Dist. of Columbia			W. T. Birthright, 1835 Eye St., N.W., Washington
Florida	July 3-14* July 3, 4†	Jacksonville	R. P. Taylor, Jr., P.O. Box 2913, Jacksonville 3
Georgia	May 30-June 1*†	Atlanta	H. M. Robertson, 206 Donehoo St., Statesboro
Hawaii	Feb. 18-22‡		J. Y. Ing, James Campbell Bldg., Honolulu
Idaho			W. M. Smith, 305 Fort St., Boise
Illinois			R. I. Humphrey, 185 N. Wabash Ave., Chicago
Indiana	Dec. 7-10*†	Indianapolis	C. A. Frech, Gary National Bank Bldg., Gary
Iowa	June 6-10*†	Iowa City	P. A. Hahn, Farmers & Merchants Bank Bldg., Burlington
Kansas	Jan. 25*†‡		R. C. Windscheffel, Medical Arts Bldg., Smith Center
Kentucky			J. J. Kelly, 102 W. Madison St., Franklin

WHAT'S YOUR SCORE?

This fall, teen-age boys and girls in every state must pass this simple nutrition quiz to qualify for participation in the National Youthpower Congress next February 11-12-13 in Chicago. The Congress is planned to foster greater public understanding of the cultural, economic and nutritional values of food. We thought you might enjoy checking this quiz yourself. (The answers are shown below.)

Question 1.

How do you define nutrition? (CHECK ONE)

a. ☐ Selection of foods good for you.
b. ☐ Digestion of food.
c. ☐ Study of foods in relation to health.
d. ☐ Knowledge of what foods are good and what foods are bad for you.

Question 2.

What is a vitamin? (CHECK ONE)

a. ☐ Something added to make food taste better.
b. ☐ An organic substance required in minute amounts for the health of the body.
c. ☐ What some foods contain to make you grow and provide energy.
d. ☐ A special class of food.

Question 3.

Basic classes of foods include: (CHECK FOUR)

a. ☐ Milk and dairy products
b. ☐ Proteins
c. ☐ Fruits and vegetables
d. ☐ Fats
e. ☐ Trace elements
f. ☐ Minerals
g. ☐ Starch
h. ☐ Vitamins
i. ☐ Whole grain, enriched or restored cereals and breads
j. ☐ Meat, fish, eggs, beans and nuts

Question 4.

Match the functions in the column at the left to the items in the right column that perform these functions. (MARK LETTERS IN SQUARES)

a. Warmth and energy
b. Growth and repair
c. Bone structure and body regulation
d. Blood formation

1. ☐ Fats and carbohydrates
2. ☐ Calcium, phosphorus and other minerals
3. ☐ Proteins
4. ☐ Iron

Question 5.

True or false? (MARK T OR F IN SQUARES)

1. ☐ Today's population in America is the best fed in history.
2. ☐ The amount of food you need depends on your age, sex and activities.
3. ☐ Eating a balanced diet is expensive.
4. ☐ A good diet should include milk products; meat; fish or eggs; fruit and vegetables; breads and cereals.
5. ☐ An overweight person is malnourished.
6. ☐ No one food supplies all the nutrients we need.
7. ☐ We all need vitamin supplements to be well nourished.
8. ☐ Sirloin is more nourishing than hamburger.
9. ☐ Your most desirable weight is about what you weigh in good health between ages 25-30.
10. ☐ People in the same family, eating the same meals all show the same signs of good or poor diet.
11. ☐ Growing heavier as we grow older is a sign of good health.

Question 6.

Listed below are essential nutrients marked 1 to 9. Each of the foods listed supply one or more of these nutrients in generous amounts. (MATCH THE NUMBERS TO THE FOODS)

1. Vitamin C
2. Protein
3. Calcium
4. Thiamine
5. Iron
6. Vitamin A
7. Vitamin D
8. Niacin
9. Riboflavin

A._____ Cod Liver Oil
B._____ Cottage Cheese
C._____ Cantaloupe
D._____ Nuts
E._____ Enriched bread
F._____ Fortified whole milk
G._____ Butter and fortified margarine
H._____ Meat
I._____ Dry beans
J._____ Eggs
K._____ Oranges

Answers: Q1 (c)... Q2 (b)... Q3 (a, c, i, j)... Q4 (1a, 2c, 3b, 4d)... Q5 (1T, 2T, 3F, 4T, 5T, 6T, 7F, 8F, 9T, 10F, 11F). Q6 (A. 6, 7—B. 2, 3, 9—C. 1, 6—D. 2, 8—E. 3, 4, 5, 8, 9—F. 2, 3, 6, 7, 9—G. 6—H. 2, 4, 5, 8, 9—I. 2 ,5—J. 2, 3, 6—K. 1

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State	*Date*	*Place*	*Secretary and Address*
Louisiana			A. R. deNux, Marksville
Maine			A. S. Appleby, Box 260, Skowhegan
Maryland	Nov. 9-11†	Baltimore	F. J. Bryce, 303 Granville Dr., Silver Spring
Massachusetts			C. R. Williams, 70 Washington St., Salem
Michigan	Jan. 24-30 June 5-11	Ann Arbor	J. L. Champagne, 3714 W. McNichols Rd., Detroit 21
Minnesota			E. A. Nelson, 2236 Marshall Ave., St. Paul 4W
Mississippi	Jan. 11-13*†	Jackson	A. H. Richter, Jr., Aven Bldg., Greenwood
Missouri	Nov. 2, 3*†	St. Louis	R. R. Rhoades, Central Trust Bldg., Jefferson City
Montana			R. O. Betzner, 303 Power Block, Helena
Nebraska			H. E. Weber, Stuart Bldg., Lincoln
Nevada	Dec. 7	Las Vegas	R. Whitehead, Box 1547, Reno
New Hampshire	June 16, 17* June 16†	Boston	S. G. Markos, 8 Renaud Ave., Dover
New Jersey	Nov. 30, Dec. 1* Dec. 2* Dec. 1†	Philadelphia Trenton Philadelphia	C. J. Schweikhardt, 150 E. State St., Trenton
New Mexico			G. D. Hastain, Box 1007, Clovis
New York	June 23, 24*	New York Buffalo	D. W. Beier, 23 S. Pearl St., Albany 7
	June 28-July 1*	New York Albany Syracuse Buffalo Rochester	
	Feb. 8†	New York Buffalo	
	Feb. 9, 10†	New York Albany Buffalo	
North Carolina			J. H. Guion Doctors Bldg., Charlotte 7
North Dakota	July 11-15	Fargo	F. A. Maides, First National Bank Bldg., Grand Forks
Ohio			D. E. Bowers, 322 E. State St., Columbus 15
Oklahoma	June 20-22* June 20, 22†	Oklahoma City	W. H. Stephens, Plaza Court Bldg., Oklahoma City
Oregon	Dec. 7-9*†	Portland	F. L. Utter, Pioneer Trust Bldg., Salem
Pennsylvania	Nov. 30, Dec. 1*	Philadelphia Pittsburgh	P. Swanson, 8111 Jenkins Arcade, Pittsburgh
	Dec. 2, 3*	Philadelphia Pittsburgh	
	Dec. 2†	Philadelphia Pittsburgh	
Puerto Rico			J. Mercado C., Comercio St. #452, San Juan
Rhode Island	Jan. 26, 27	Providence	F. M. Hackett, 267 Academy Ave., Providence
South Carolina			W. J. Brockington, 1508 Washington St., Columbia 1
South Dakota			H. T. Aker, Canton
Tennessee	Dec. 14-18*†	Memphis	C. R. Aita, Bennie-Dillon Bldg., Nashville
Texas			R. T. Weber, Capital National Bank Bldg., Austin 16
Utah			R. W. Fishburn, 4 Professional Center, Brigham City
Vermont	June 17-29*†	Burlington	P. M. Fitch, Newport
Virginia	June 13-18* June 15, 16†	Richmond	J. M. Hughes, Medical Arts Bldg., Richmond
Washington			T. W. James, 1612 Hewitt Ave., Everett
West Virginia	June 21-23* June 20†	Morgantown West Liberty	A. B. Drake, 1355 Fourth Ave., Huntington
Wisconsin			S. F. Donovan, Tomah
Wyoming			W. J. Ryan, Boyd Bldg., Cheyenne

**Dental examination. †Dental hygiene examination. ‡Write to secretary of dental examining board for information on locations of examinations. Most states require applications to be in 30 days prior to examination date.*

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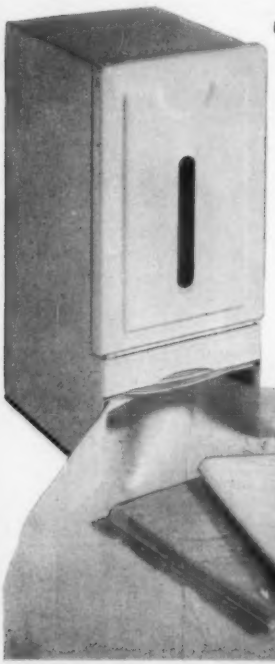

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MEETINGS OF OTHER ORGANIZATIONS

Name	*Date*	*Place*	*Secretary or Chairman and Address*
American Academy of Dental Medicine	Dec. 6	New York	W. I. Levine, 809 Cathedral St., Baltimore
American Academy of Oral Pathology	Apr. 17-19	Minneapolis	R. J. Gorlin, School of Dentistry, University of Minnesota, Minneapolis 14
American Academy of Restorative Dentistry	Feb. 6, 7	Chicago	M. H. Mortonson, Jr., 735 N. Water St., Milwaukee 2
American Association for Cleft Palate Rehabilitation	May 12-14	Denver	D. C. Spriestersbach, University Hospitals, Iowa City
American Association of Dental Schools	Mar. 20-23	Chicago	R. H. Sullens, 840 N. Lake Shore Dr., Chicago 11
American Association of Orthodontists	Apr. 24-28	Washington, D.C.	E. E. Shepard, 8230 Forsyth Blvd., St. Louis 5
American Board of Oral Pathology	Dec. 5, 6		D. A. Kerr, University of Michigan, School of Dentistry, Ann Arbor, Mich.
American Board of Oral Surgery	Dec. 7 Apr. 1-4	Chicago	L. M. FitzGerald, Roshek Bldg., Dubuque, Iowa
American Board of Orthodontics	Apr. 18-23	Washington, D.C.	W. L. Wylie, University of California, School of Dentistry, Medical Center, San Francisco 22
American Board of Pedodontics	Dec. 14-17	Chicago	R. L. Ireland, College of Dentistry, University of Nebraska, Lincoln 8, Neb.
American Institute of Oral Biology	Nov. 8-12	Palm Springs, Calif.	M. G. Lewis, 2240 Channing Way, Berkeley 4, Calif.
Central Dental Association	Feb. 14-20	Aspen, Colo.	B. A. Gilbertson, Lowry Medical Arts Bldg., St. Paul
Chicago Dental Society	Feb. 7-10	Chicago	K. S. Richardson, 30 N. Michigan Ave., Chicago
Congreso Internacional Odontologico Argentino-Uruguayo	Nov. 8-13	Buenos Aires, Argentina	R. Otano A., Junín 959, Buenos Aires, Argentina
Council on Dental Education, Dental Aptitude Tests	Jan. 8, 9 Apr. 22, 23		S. Peterson, 222 E. Superior St., Chicago 11
Dallas Mid-Winter Dental Clinic (Thirty-third)	Jan. 24-27	Dallas	B. Lawrence, 3200 Maple Ave., Dallas 4
Dental Congress of Paris (Sixty-fourth)	Nov. 12-18	Paris, France	L. A. Celestin, 31, Rue Tronchet, Paris 8c, France
Denver Dental Association	Jan. 10-13	Denver	T. O. Clark, 724 Republic Bldg., Denver 2
Federation Dentaire Internationale, 48th Annual Meeting	June 20-25	Dublin, Ireland	G. H. Leatherman, 35 Devonshire Place, London W.1, England
Greater New York Dental Meeting (Thirty-fifth)	Dec. 7-11	New York	M. Purdy, Hotel Statler-Hilton, New York 1
Greater Philadelphia Annual Meeting	Mar. 8-11	Philadelphia	M. Kohn, Sheraton Hotel, 17th St. and Pennsylvania Blvd., Philadelphia 3
International Association for Dental Research	Mar.	Chicago	D. Y. Burrill, Northwestern University Dental School, 311 East Chicago Ave., Chicago 11
Mexican Dental Association, Fifth Congress	Nov. 15-18	Mexico, D.F.	R. E. Woodworth, Sinaloa No. 9, Mexico 7, D.F.
Mid-Continent Dental Congress	Nov. 1-4	St. Louis	J. E. Brophy, 8013 Maryland Ave., St. Louis 5
Midwest Society of Periodontology	Feb. 7	Chicago	G. Roth, 1108 E. 10th St., Kansas City 10, Mo.
Montana, Ninth District Dental Society	Jan. 21-23	Billings	C. H. Betzer, 1231 N. 29th St., Billings
National Board of Dental Examiners	Nov. 30, Dec. 1		G. J. Casey, 222 E. Superior St., Chicago 11
New Orleans, Dental Conference, Twelfth	Nov. 8-11	New Orleans	A. A. Copping, 4704 Paris Ave., New Orleans
Ontario Dental Association	May 15-18	Toronto, Canada	Mrs. W. C. Durham, 230 St. George St., Toronto 5, Canada
Pan American Congress of Children's Dentistry	Nov.	Bogota, Colombia	B. Gomez H., Sociedad Colombiana de Odontopediatria, Carrera 13, No. 41-58, Apartado Aerco 70-13, Bogota, D.E., Colombia

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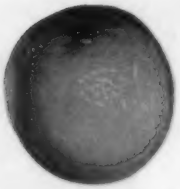
Pan American Odontological Association (Twenty-third)	Dec. 9	New York	R. H. Brodsky, 14 E. 81st St., New York
Panamanian (Isthmus) Odontological Association, Third Dental Congress	Jan.		A. H. Berguida G., P.O. Box 4115, Panama, Republic of Panama
Paris International Dental Meeting (Thirty-third)	Nov. 23-29	Paris, France	M. J. Lang, 5, rue Raymond Losserand, Paris 14, France
Thomas P. Hinman Dental Meeting	Mar. 27-30	Atlanta, Ga.	T. J. Hicks, Jr., Doctors Bldg., Atlanta 8, Ga.



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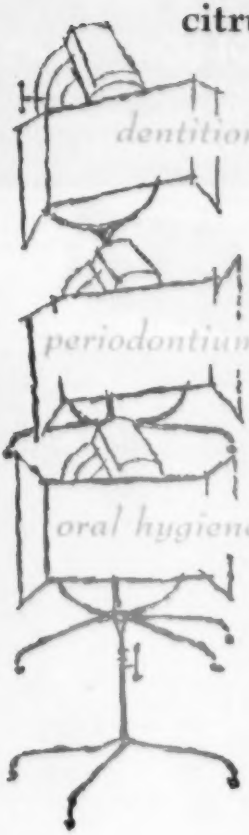

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1. King, C. G.: J. Am. Diet. A. 30:13, 1954.
2. Kelsten, L. B.: J. Dent. Med. 10:67, 1955.
3. Amer. Dent. Assoc.: Diet and Dental Health, Chicago, 1955, pp. 7-8.

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Edward C. Hinds, Consulting Editor

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Management of Dry Sockets — *Charles C. Alling*

Choice of Anesthesia — *Morgan L. Allison*

Periapical Surgery — *Frank B. Trice*

Complications in Oral Surgery — *Richard J. Burch and Staff*

Pre- and Postoperative Care in Oral Surgery — *John D. Gehrig*

Antibiotics in Oral Surgery — *Harold J. Zubrow*

Odontogenic Cysts — *James E. Chipps*

Transplantation and Replantation — *Merle L. Hale*

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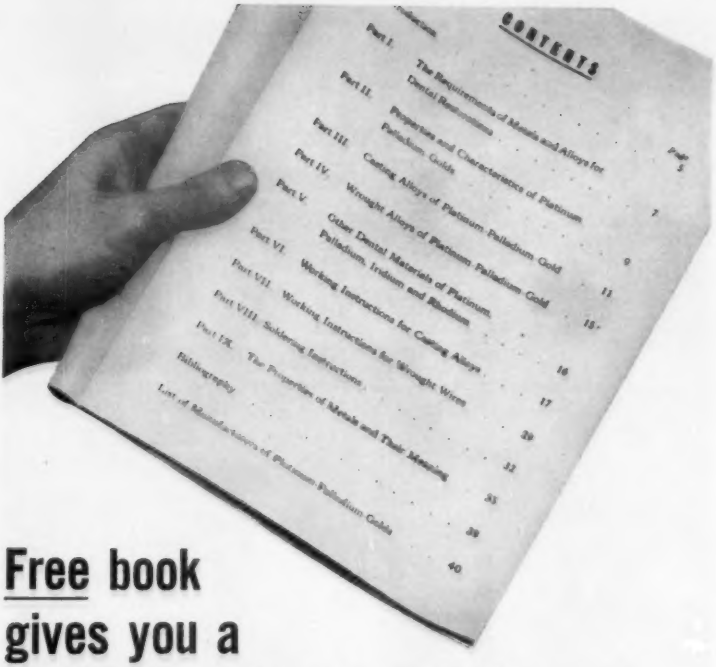
CONTENTS
Part I. The Requirements of Metals and Alloys for Dental Restorations
Part II. Properties and Characteristics of Platinum, Palladium, Golds
Part III. Casting Alloys of Platinum-Palladium-Gold
Part IV. Wrought Alloys of Platinum-Palladium-Gold
Part V. Other Dental Materials of Platinum, Palladium, Iridium and Rhodium
Part VI. Working Instructions for Casting Alloys
Part VII. Working Instructions for Wrought Wires
Part VIII. Soldering Instructions
Part IX. The Properties of Metals and Their Meanings
Bibliography
List of Manufacturers of Platinum-Palladium-Golds

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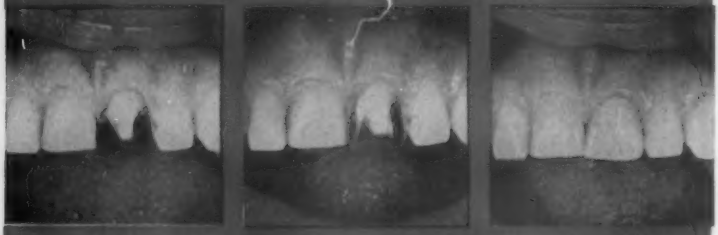

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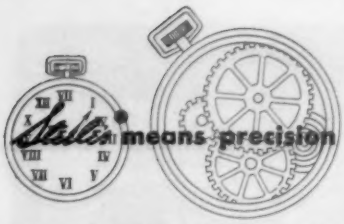

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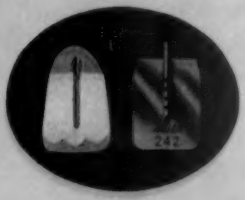

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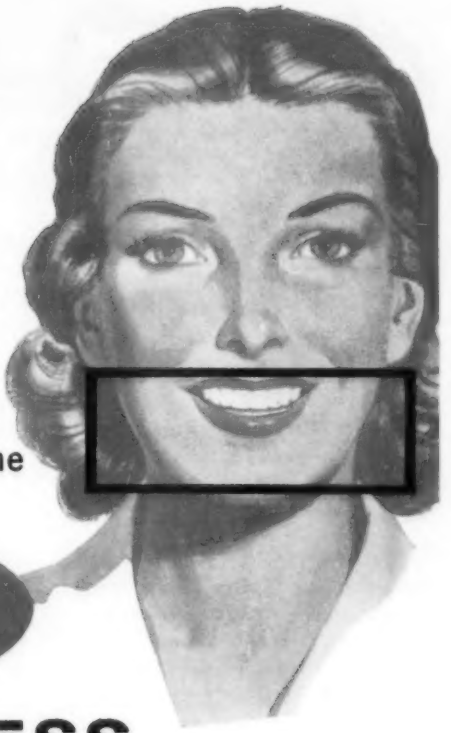

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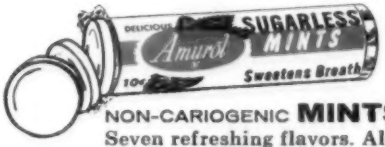

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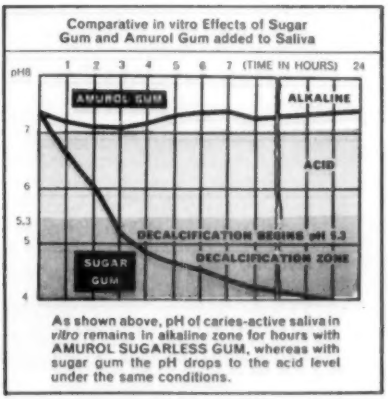

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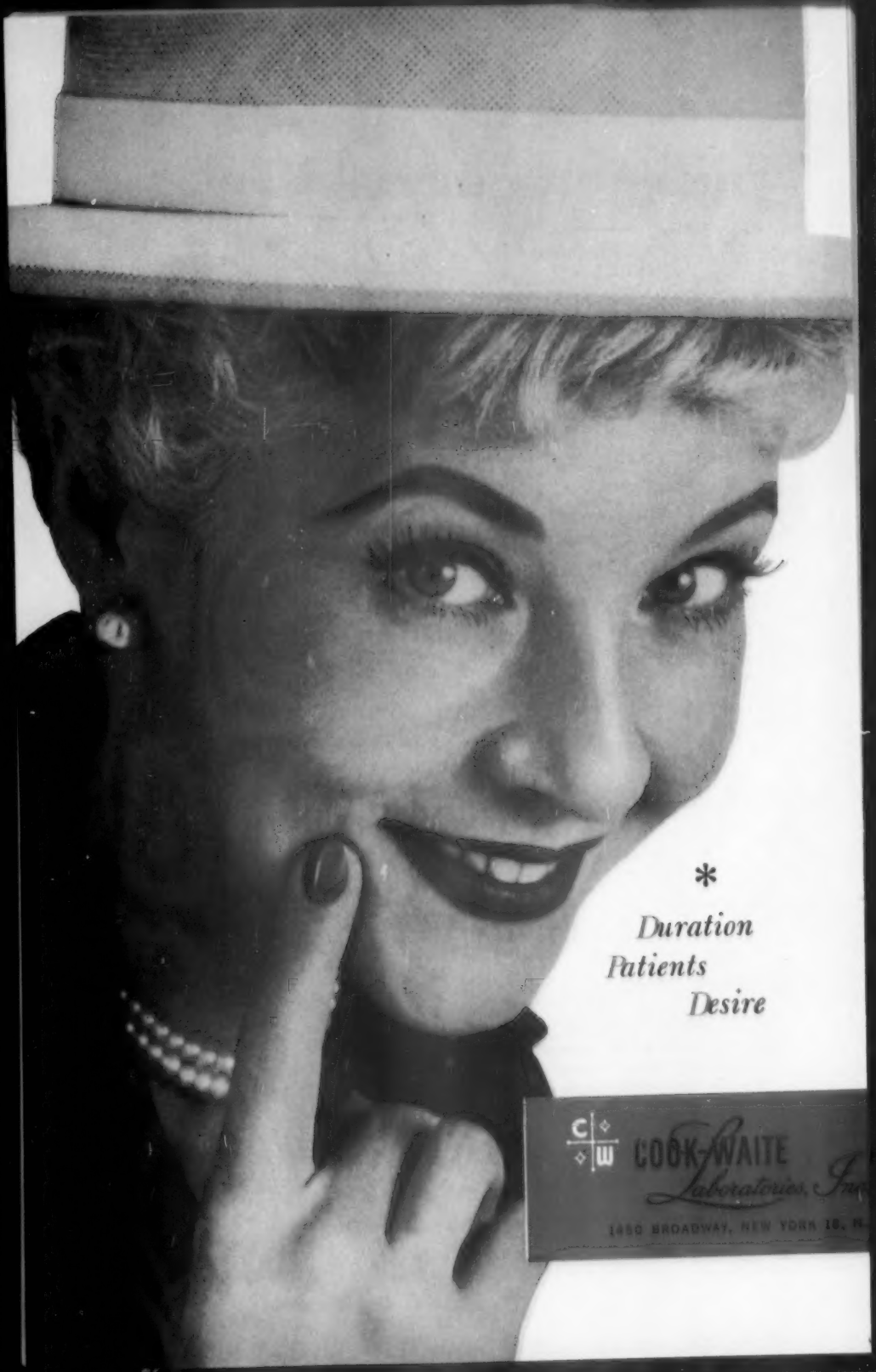
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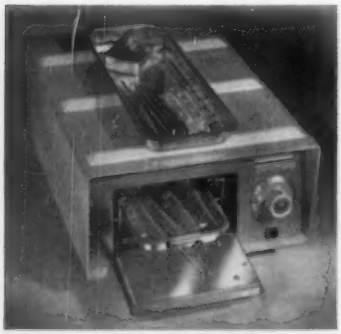

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A

C

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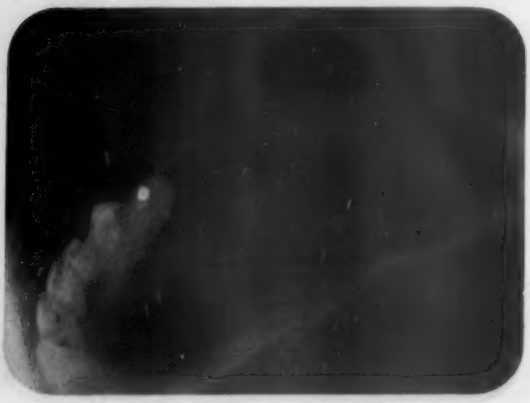
B

D

2 **OCCLUSAL RADIOGRAPH**—Note how much more informative is the occlusal view of the radicular cyst. Its anteroposterior extent, its buccolingual diameter, and the thinness of the buccal cortex are clearly observed.



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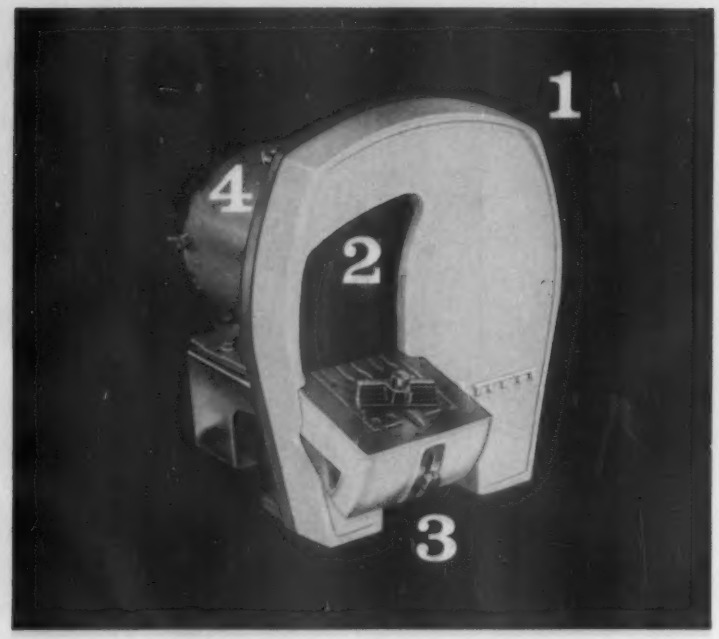

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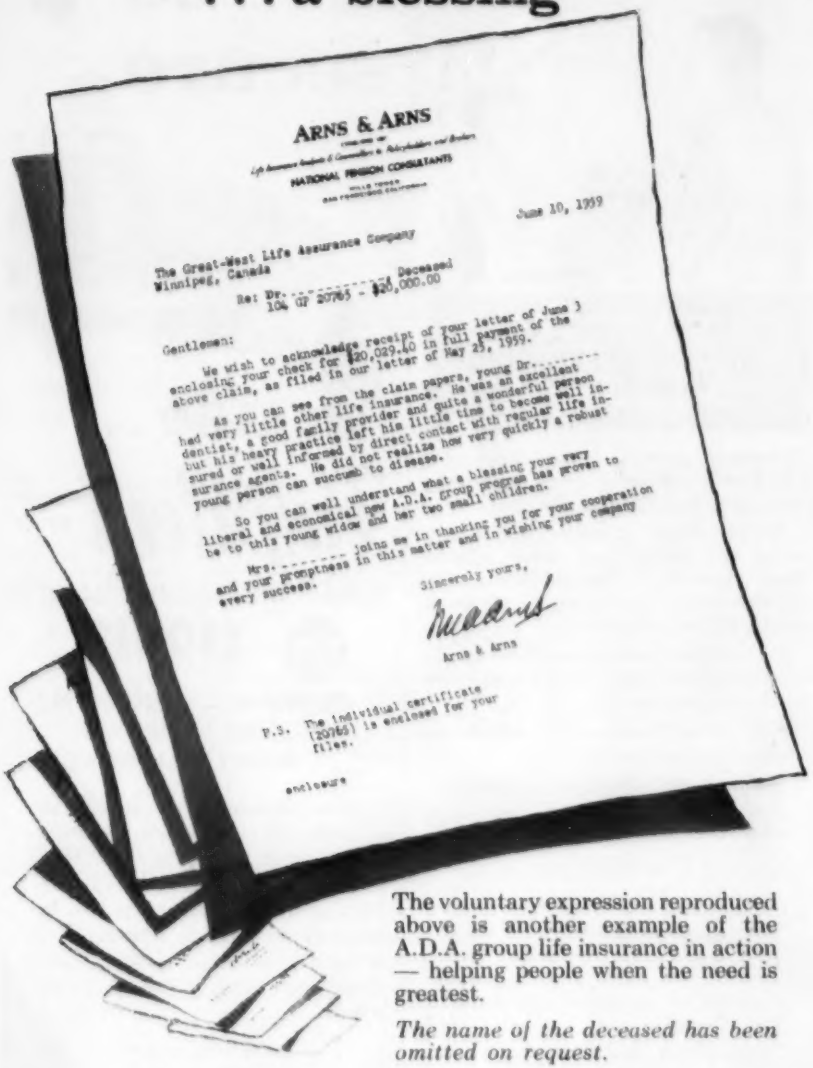

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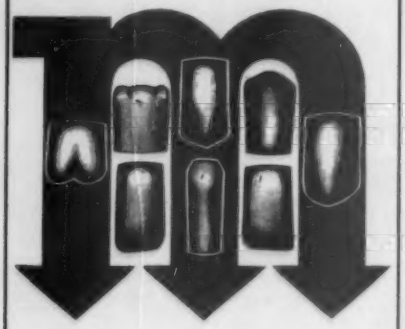

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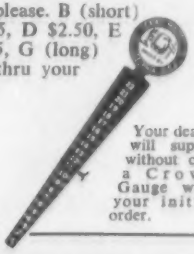

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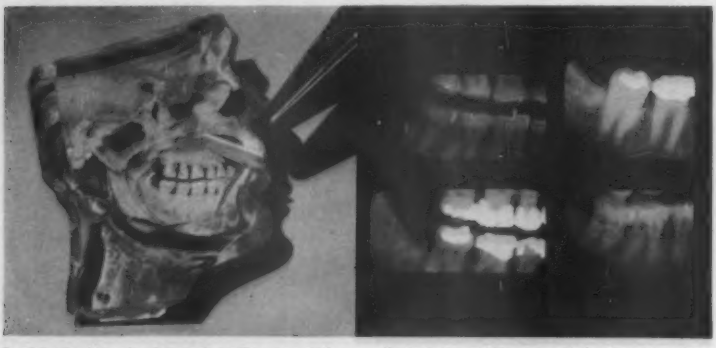
NO. 22



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Better Things for Better Living . . . *through Chemistry*

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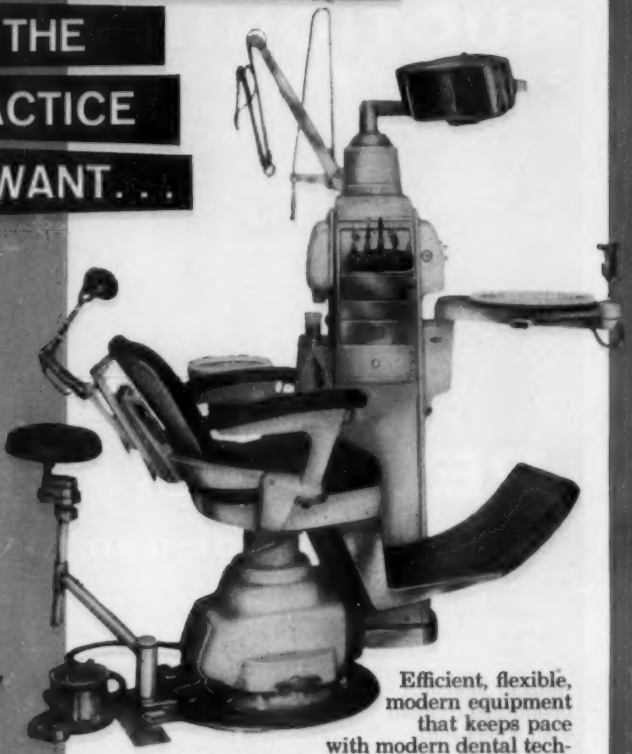

Castle General Vision Light

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Efficient, flexible, modern equipment that keeps pace with modern dental techniques and growing practices. Ritter/Castle dental operatory equipment helps make your treatment days more rewarding . . . less tiring. It also caters to your patients comfort . . . encourages relaxation . . . makes them easier to work with. Here's equipment modern in appearance . . . but *most* important, designed for dental techniques today *and* tomorrow!

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☐ Century Unit ☐ Century Chair ☐ Century Light ☐ Century X-ray ☐ 999 Autoclave ☐ General Vision Light

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AT A NEW LOW PRICE

PEL-VAC *by Pelton*

LEADS IN POPULARITY!

Install this revolutionary new unit in your office. It has outsold all other comparable equipment on the market to date. Here's why:

Powerful yet gentle for every dental need. Clears the operating field of all blood, bone, tooth fragments, saliva, amalgam, abrasives, debris, slurry and water coolant. Attaches to operating light column in a few minutes. No special plumbing or wiring.

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Flapper valve in lower canister empties contents in cuspidor bowl when motor is turned off. No tanks or bags to empty or replace. Foot switch is standard.

RHEOSTAT NOW AVAILABLE

90% of all dental operations require less suction than the Pel-Vac maximum. The Rheostat reduces both motor speed and suction for maximum quietness.

DESIGNED TO ATTACH TO ALL UNITS. AVAILABLE IN SIX STANDARD DENTAL COLORS

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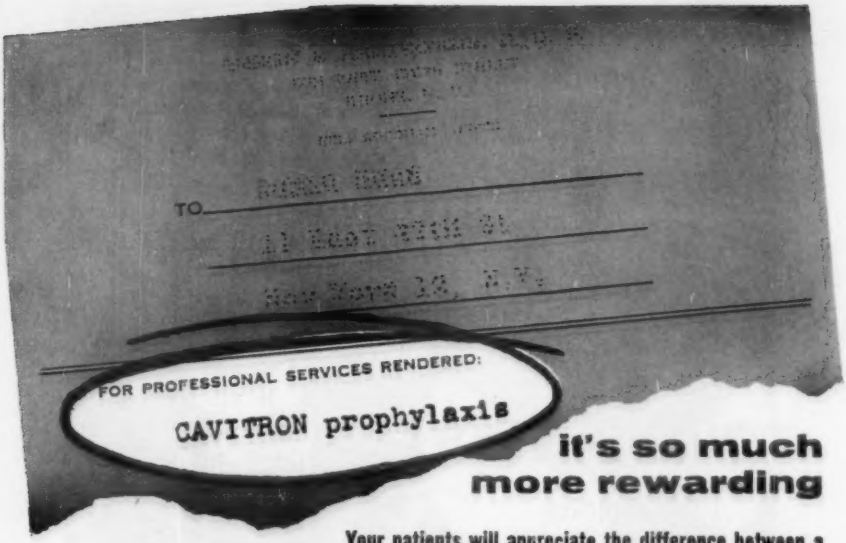
Professional equipment since 1900



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The Unit is fully portable, can be installed in minutes, needs no maintenance. It is supplied with a basic set of quick-snap-in prophylaxis tips which provide ready access to all areas. Tips are normally blunt, never need sharpening. No abrasive is used.

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And it's easier for you . . .
You merely guide the lightweight handpiece—no force is required, so there's no finger fatigue . . . and many doctors report a truly dramatic saving in chair time.

*Tascher, P. J.: The Present Status of Ultrasonic Dentistry. N.Y. State D. J. 25:183 (May) 1959

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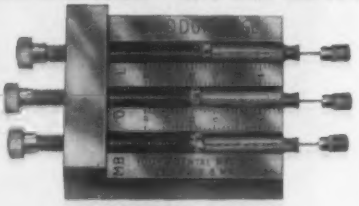

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. . . gives you 48 reamers at your finger tips numbered for quick finding and replacement.

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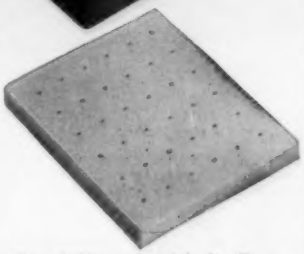

Specially moulded Bur Block that fits into its Matching Case . . . provides protective Bur Storage Compartment with clear-view cover!

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These Exclusive Features Produce SMOOTHER CAVITY WALLS

This Bonus Package gives you 36 Carbex FG Burs for
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Attached to every package is a FREE Carbex Bur, as a trial sample. If not satisfied with its performance, return the unopened package to your dealer for full credit.

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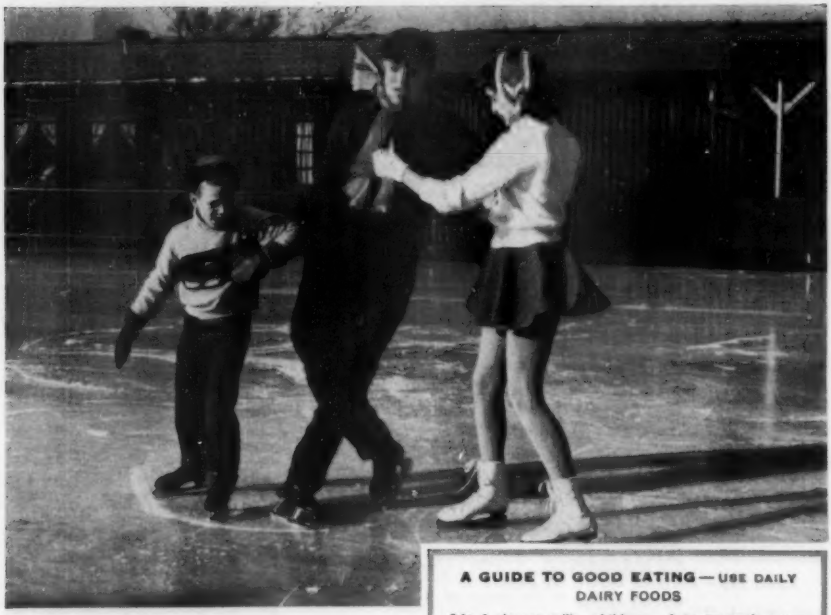

CONTROL

Foods can provide many minerals needed for control of body functioning . . . as well as for structure of body tissues . . . but special consideration needs to be given to insure that the diet contains enough of certain minerals.

The minimum quantities of foods listed in *A Guide to Good Eating* can provide most of the Recommended Dietary Allowances for *calcium . . . 2/3 from milk group . . . and ¼ from other groups.*
iron . . . 1/3 from meat group . . . ¼ from vegetables and fruits . . . and 1/5 from enriched breads and cereals.

Calcium is essential to normal blood clotting, muscle contraction, nerve functioning and cell permeability . . . in addition to its main role in the growth and maintenance of bones and teeth. Iron is used in the formation of hemoglobin, the red blood pigment which carries life-giving oxygen from the lungs to body cells. Phosphorus . . . which plays a vital part in the energy metabolism of cells as well as in formation of bony tissues . . . is provided by foods in all four groups . . . especially those which supply calcium and protein. Potassium, sodium and chlorine are involved with maintaining water balance in the body. Potassium is abundant in animal and plant foods . . . sodium and chlorine are present in foods and table salt. Copper, cobalt, magnesium, manganese, molybdenum and zinc take part in various enzyme reactions . . . and are supplied in needed amounts by foods listed in the "Guide."

A GUIDE TO GOOD EATING — USE DAILY

DAIRY FOODS

3 to 4 glasses milk—children • 4 or more glasses—teenagers • 2 or more glasses—adults • Cheese, ice cream and other milk-made foods can supply part of the milk

MEAT GROUP

2 or more servings • Meats, fish, poultry, eggs, or cheese—with dry beans, peas, nuts as alternates

VEGETABLES AND FRUITS

4 or more servings • Include dark green or yellow vegetables; citrus fruit or tomatoes

BREADS AND CEREALS

4 or more servings • Enriched or whole-grain added milk improves nutritional values

Fluorine . . . not demonstrated to be a dietary essential...but shown to give developing teeth substantial protection from dental caries . . . is present in many foods and natural and treated water.

When combined in well-prepared meals, foods selected from each of those four food groups and seasoned with iodized salt can provide all needed minerals . . . while satisfying the tastes, appetites and other nutrient needs of all members of the family . . . young and old.

The nutritional statements made in this advertisement have been reviewed by the Council on Foods and Nutrition of the American Medical Association and found consistent with current authoritative medical opinion.

Since 1915 . . . promoting better health through nutrition research and education.

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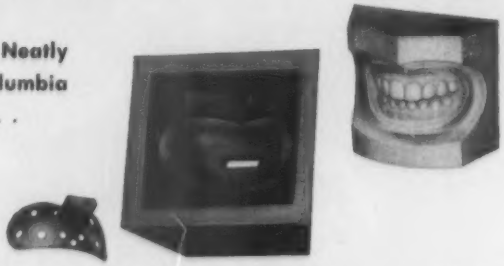
Anterior-Bite Models Made Neatly and Quickly with the NEW Columbia *Anterior-Bite* Model Former . . .



- A special anterior impression tray takes impressions of both upper and lower together; no need for separate impressions.
- Impression tray is then pressed into slot in the flexible *rubber* model former.
- With one pouring of plaster or stone a neat, sharply-outlined model of the anterior bite . . . in one piece . . . is easily produced.

Neat, presentable models of the anterior bite are most advantageous in a "before-and-after" demonstration to the patient.

Order this anterior-bite model former today — Cat. No. 903 — $7.50

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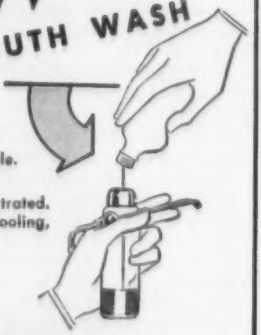
The Ideal Mouth Rinse for Professional and Home Use

S·S·White
ORALINE ▶▶▶ MOUTH WASH



√ *8-ounce Plastic Bottle for your office. Space-saving—easy to handle. Just remove cap—tilt—squeeze.*

√ *Economical because it's concentrated. Makes two gallons of soothing, cooling, cleansing rinse.*

Order from your salesman. Recommend—prescribe Oraline for routine home use.

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FREE! Write on professional letterhead for PRESCRIPTION PADS

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DWG. A: Contact too broad occluso-gingivally.

DWG. B: Bucco-lingual contact area too broad.

DWG. C: Bucco-lingual contact area normal.

Contact areas

These drawings of two bicuspids, one mesio-distal section and two occlusal views, are used to illustrate certain common contact problems.

In Drawing A of the mesio-distal section, for example, the contact is too broad in the occluso-gingival dimension, and stringy foods are apt to be caught and held.

The occlusal view in Drawing B shows a broad bucco-lingual contact area that prevents food from scouring the embrasures as it would, for example, in Drawing C where the contact is a normal one.

Drawing C, showing the normal contact area, obviously allows food to sweep into the embrasures which are so shaped as to provide a sluice-way effect with resulting tissue stimulation and self-cleansing action.

(Prepared under the direction of competent dental authority.)

SAY **NEY** BEFORE YOU SAY *Gold*

NEY-ORO
A-1 inlays
B-2 bridges
B-3 partials

THE J. M. NEY COMPANY
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RECOMMENDED FOR ULTRA-HIGH SPEEDS

These scalpel-sharp, diamond-hard carbide burs are engineered *specifically* for full efficiency at ultra-high speeds. You have the widest range of sizes and shapes to select from—in conventional and universal (break-through) types. Further, your Dealer stocks Busch-Widia Burs in *seven different shank lengths*, including p.c. style for friction grip handpieces.

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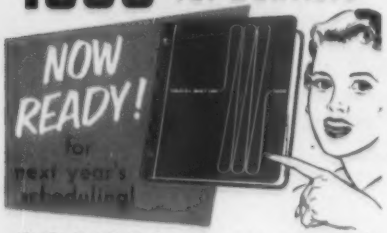

THE DAILY LOG serves as a well qualified "business manager" in your office — the simplest of any professional system. Only a few minutes a day required to keep complete business records; helps you avoid tax troubles; saves you time and money. Fully dated; looseleaf; printed new each year.

PRICE: $7.75 for CALENDAR YEAR
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150 disposable ejectors for only $3.75 with FREE Nickle Plated Adapter

Order from your supply house

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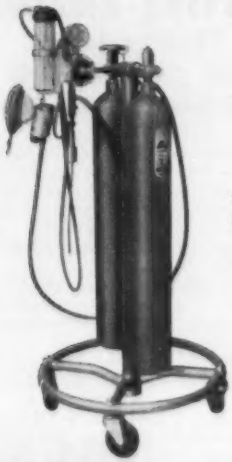

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OXYGEN, an essential in modern dental offices

Oxygen for supportive therapy and resuscitation should be readily available in every dental office. Its administration may prevent a serious emergency or save a life. Although serious emergencies are comparatively rare, *they do occur*. A patient has the right to expect his dentist to be prepared to handle them.

The outcome of an emergency may in many cases be determined by the *immediate* treatment while awaiting the arrival of other professional help. The HANDY resuscitator is an essential.

The HANDY resuscitator is small, light, safe, effective, reliable and extremely simple to operate. No pressure beyond a safe amount can reach the patient's lungs. Full and accurate control of the respiratory rate is at the finger tips of the operator.

*HANDY is a trademark.

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THE *HANDY RESUSCITATOR does *three* important things:**

1 As *Resuscitator*, it automatically breathes for a person whose respiration has failed and automatically adjusts the depth of respiration for an infant, child or adult.

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3 As *Aspirator*, it provides sufficient suction to remove obstructing material from the throat, such as mucus or vomitus.

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ULTRA BRAND

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Gives the most homogenous mix, thus permits smooth wax-like carving. Develops *high initial* and permanent strength, with corresponding low flow. Assures permanently sealed cavities. Resists tarnish and oxidation. Fillings retain mirror-like lustre indefinitely.

Carefully graded to contain round micro-fine particles. This enables removing the excess mercury, thereby increasing the strength of the filling.

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Ask your dealer for 10 oz. plus FREE package. It is moderately priced and superior in performance.

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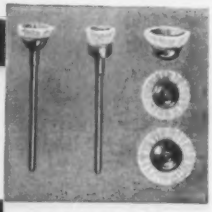
These scientifically designed brushes clean with the ends of the bristles — ***not the sides. They reach into the crevices and other spaces other cleansers don't penetrate. Require minimum pressure; generate no heat. Specify "Robinson's"—through your dealer.***



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FLUORIDE TABLETS
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Complete information, including dispensing labels, prices, and prescription instructions, furnished free upon request. Write to:

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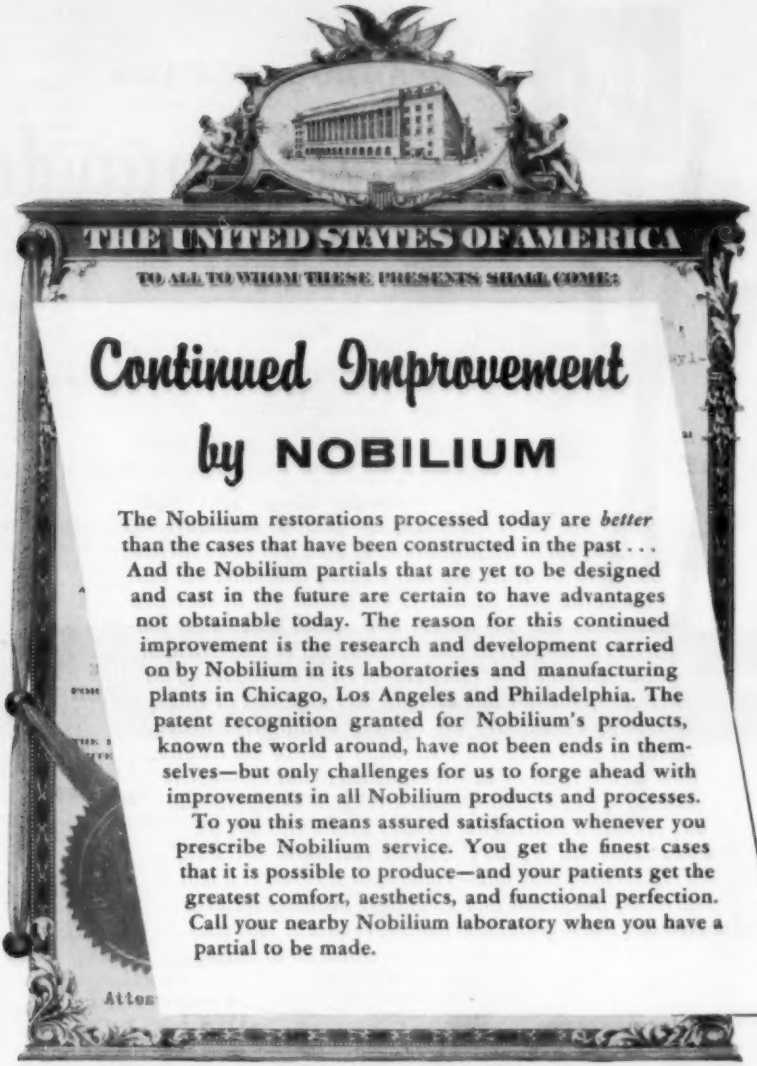

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College of Medical Evangelists
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College of Dentistry
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School of Dentistry
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Emory University
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Atlanta 3, Georgia

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Chicago 12, Illinois

The Dental School
Northwestern University
311 East Chicago Avenue
Chicago 11, Illinois

College of Dentistry
University of Illinois
808 South Wood Street
Chicago 12, Illinois

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Indiana University
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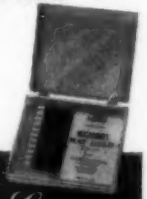

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Index to advertisements—November 1959

Alvin Co., A. C. 1084
American Dental Association
1960 American Dental Directory 882
Dental Aptitude Test 1100, 1101
National Board Examinations 1092
Relief Fund 1075
American Ferment Co., Inc. 1052
Amurol Products Co. 1057
Astra Pharmaceutical Products, Inc. 885, 887, 889, 891
Austenal, Inc. 1073, 1074

Block Drug Company, Inc. 888, 892, 1068, 1069, 1078
Boos Dental Laboratories, Inc., Harry P. . 1063
Bosworth Company, Harry J. 1056
Bowen & Company, Inc. 1053
Bristol-Myers Company ..... 4th Cover
Buffalo Dental Mfg. Co., Inc. 1098
Burton Manufacturing Company 1058
Butler Company, John O. 1081

Castle Company, Wilmot 1067
Caulk Company, The L. D. 1050, 1051
Cavitron Equipment Corp. 1089
Chayes Dental Instrument Corp. 1059
Church & Dwight Co., Inc. 1065
Classified Advertising . . 1079, 1080, 1081, 1082, 1083, 1084
Coe Laboratories, Inc. 890
Columbia Dentoform Corporation 1094
Columbus Dental Manufacturing Co., The 1054
Colwell Company, The 1096
Cook-Waite Laboratories, Inc. . . . 1060, 1061
Crescent Dental Mfg. Co. 1085

Dentists' Supply Co. of N. Y., The 894
Du Pont de Nemours & Co., E. I., (Inc.) 1086

Eastman Kodak Company 1070, 1071
Edroy Products Co. 1102
Electronic Control Corp. 1082
Engelhard Industries, Inc. 1064
Exakta Camera Company 1090

Florida Citrus Commission 1043
Fluoritab Corporation 1098

Gesner, Inc., M. A. 1048
Getz Corporation, The William 1041
Great-West Life Assurance Company, The 1077
Grossman Clothing Company 1102

Hamilton Manufacturing Company 883

International Nickel Company, Inc. 1049

Jelenko & Co., Inc., J. F. 881, 1083
Jelinek Dental Alloy, H. 1098
Johnson & Johnson 884, 1066

Kerr Manufacturing Company 1091
Kumfort-Tyme Co. 1084

Lorvic Corporation, The 1035

Masel Co., Isaac 1080
Mosby Company, The C. V. 1076

National Cylinder Gas Divison Chemetron Corporation 1097
National Dairy Council 1093
Ney Company, The J. M. 1095
Nobilium Products, Inc. 1099
Novocol Chemical Mfg. Co., Inc. 1105
Nu-dent Porcelain Studio, Inc. ..... 3rd Cover

Oral B Company 1062

Pelton & Crane Company, The 1088
Pfingst & Company, Inc. 1096
Professional Budget Plan 1058
Professional Printing Company, Inc. 1082

Ritter Company, Inc. 1087
Rower Dental Mfg. Corp. 1078

Saunders Company, W. B. 1045
Schneider Dental Laboratory, M. W. 1044
Security Products Co. 1039
Squibb & Sons, E. R. 1106
Stim-U-Dents, Inc. 1055
Surgident, Ltd. 1044

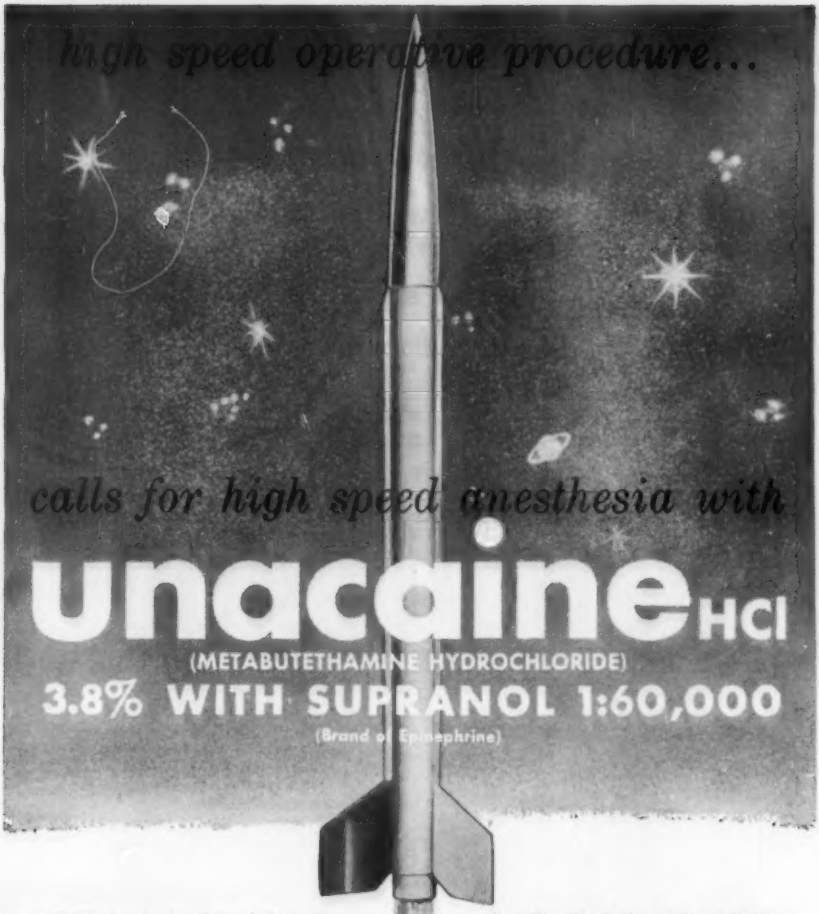
Torit Manufacturing Co. 1072

U. S. Air Force 893
U. S. Savings Bonds 1102

Walbro, Inc. 1096
Wheat Flour Institute 1037
Whip-Mix Corporation 1054
White Dental Mfg. Co., The S. S. 1046, 1047, 1090, 1094
Whitehall Laboratories 1033
Williams Gold Refining Co., Inc. 1103

X-Ray Mfg. Corp. of America 886

Young Dental Mfg. Co. 1090



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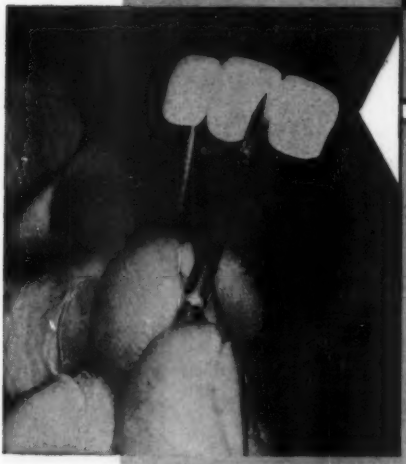

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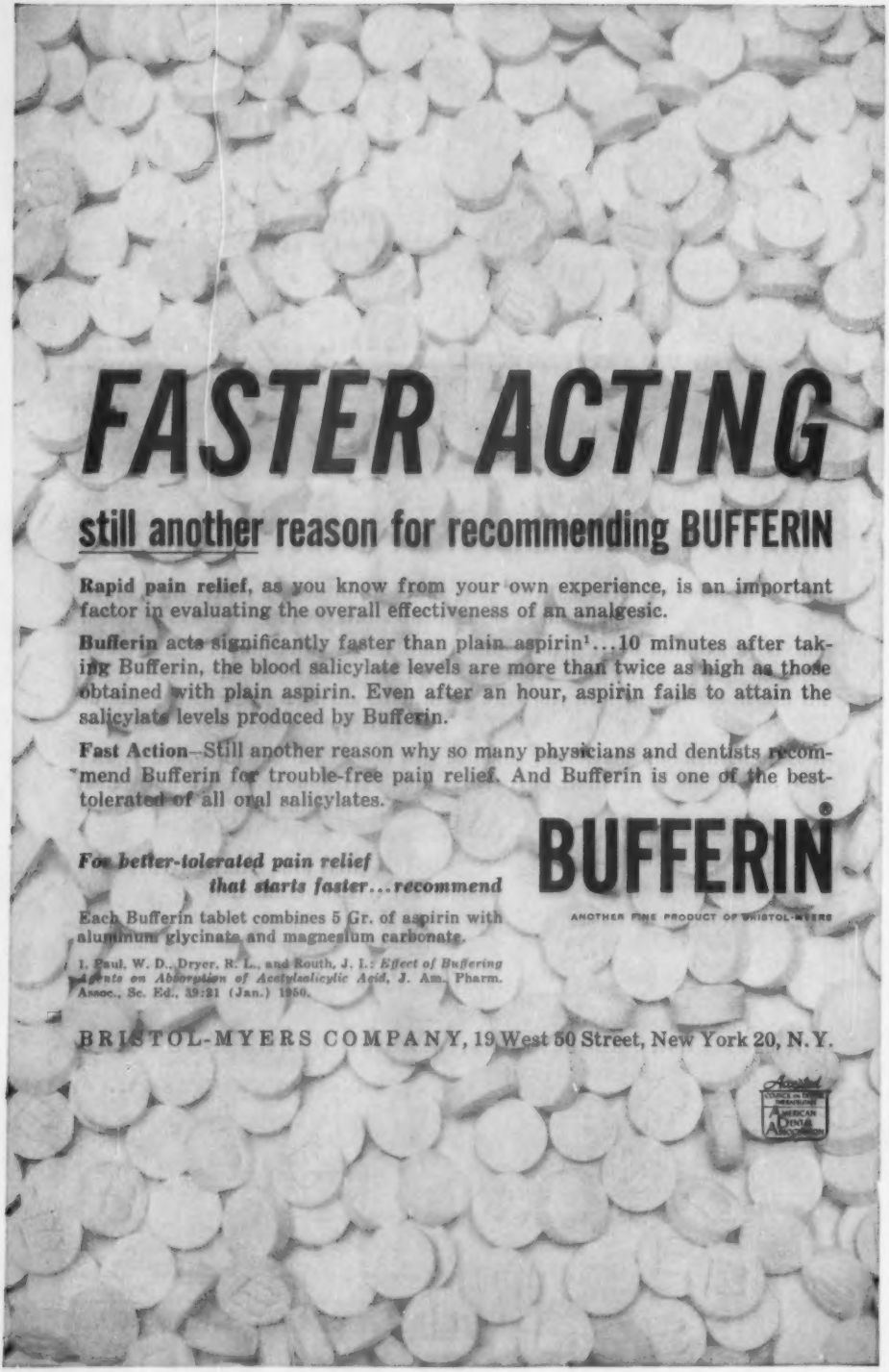
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